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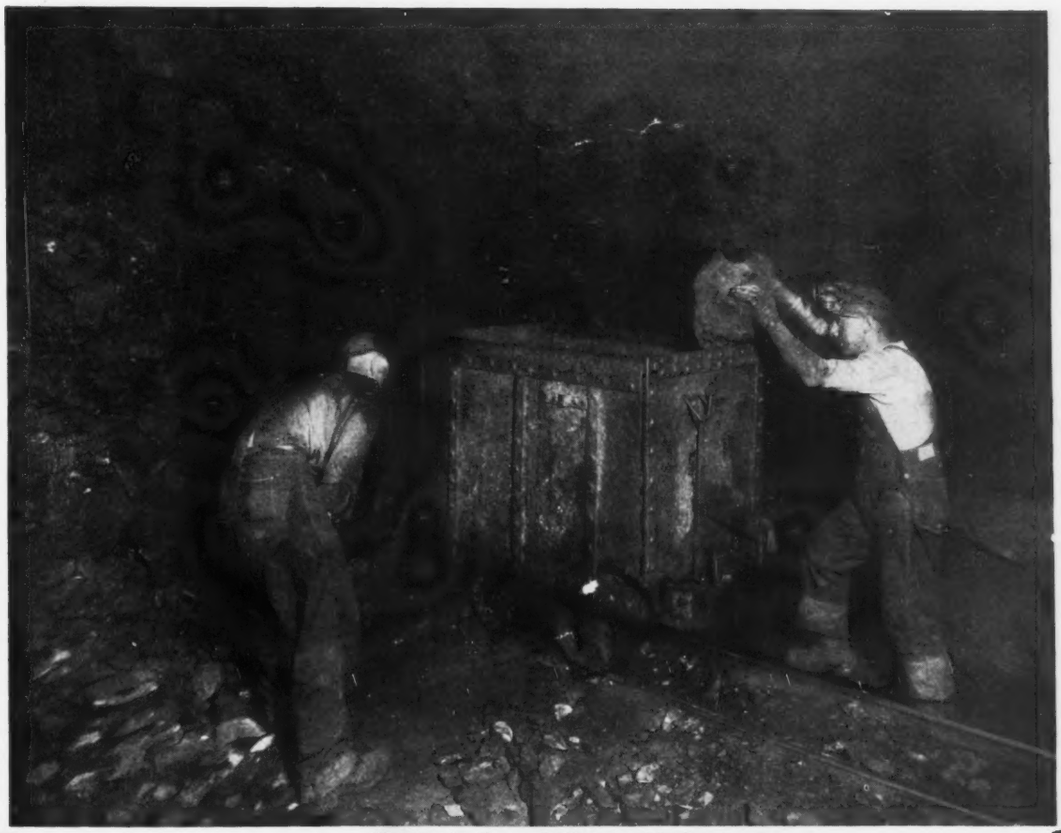

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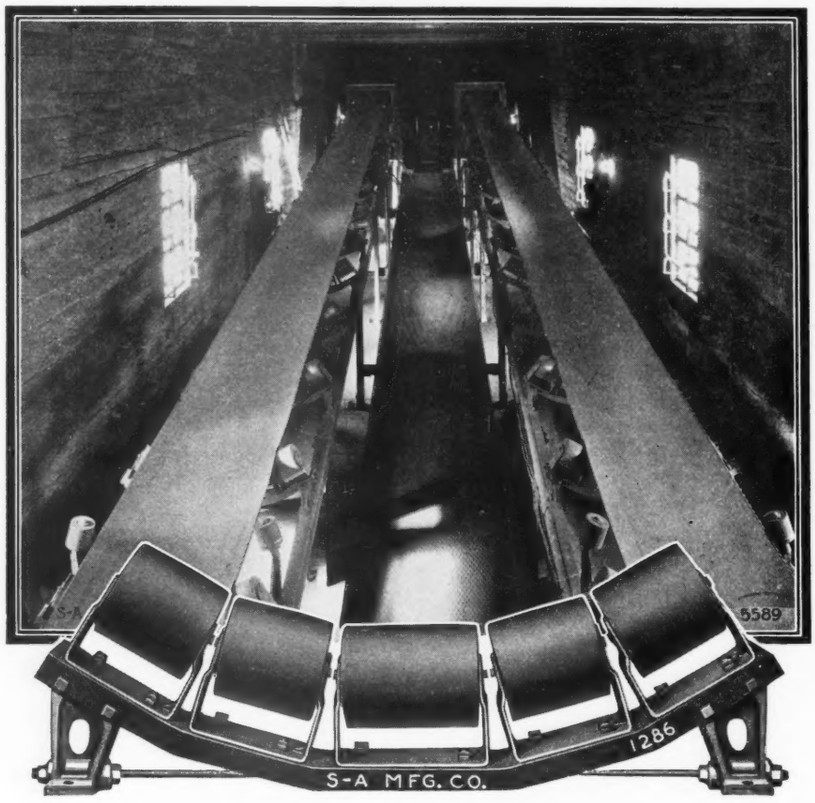
A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

December 2, 1922



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The Origin of Nitrate Deposits

THE BULLETIN on California nitrates by the U. S. Geological Survey, reviewed on page 995, affords an unusual insight into the origin of nitrates and justifies conclusions further than any which we have been able to find deduced in the bulletin. The facts are, however, given, from which we offer certain deductions. Dr. Gale, in the preface, observes:

"The accumulation of nitrate salts at or near the surface in clay soils of different geologic ages and relations tends to show that the nitrate owes its preservation to peculiar surface conditions and that the mere fact of its presence does not imply some deep-seated source where it occurs in greater quantity. It is much more likely that the nitrate is formed at the surface in essentially the same way that nitrates are now being formed in fertile soils, and probably in many soils that are not fertile, all over the world."

We agree fully with the first sentence, but not with the second. Certainly, "the nitrate owes its preservation to peculiar surface conditions," and that is a fact of the greatest commercial value, for, as Dr. Gale further observes, "consequently, the idea of exploring by deep drilling for a supposed source of the surface nitrate incrustations finds no warrant in the evidence that has been collected." But there is probably a great difference between the accumulation of nitrates in fertile soils (we assume that he uses the term "fertile soils" in distinction from "arid soils") and their accumulation in desert soils and subsoil caliche, as in California and most strikingly in Chile. Briefly, we refer the former (the nitrates in "fertile" soils) to organic, the latter (in desert soils) essentially to inorganic, agencies. In fertile soils the fixation of nitrogen is from the air through the agency of bacteria, independently, and to a less degree through the agency of nitrogen-fixing plants.

The excretions of animals and the decay of animal matter add to the list of organic sources of the nitrogen in fertile soils, this nitrogen from plant and animal sources having been fixed from the air through the organisms involved. Practically the only concentrated source of nitrogen—of nitrogen ore, as it were—from this source is the guano, the accumulated excreta of birds or bats, in caves or in roosting places otherwise protected from the leaching action of surface waters, as on arid islands. Either cave protection from rains, or the protection of a dry climate, is essential for the accumulation of any commercial quantity of the highly water-soluble sodium nitrate salts.

It still remains a striking fact that the only vast accumulation of nitrates is in Chile, where the age-long aridity of the climate seems to minimize or eliminate the agency of organic action in fixing the nitrogen from the air. Yet in Chile, as in California, the nitrates occur in a hardened soil or subsoil cemented by various salts, including sodium nitrate. It is a layer in contact with the air as well as with the rock. Thus, the nitrate deposits of Chile and of California have these features in common, that they are confined to the "contact-zone" between atmosphere and rock; that they lie in an arid climate, and in a belt of intense Tertiary and recent volcanic action. Bear in mind that in the first group, that of the accumulation of nitrogen in ordinary soils, the nitrogen is abstracted directly from the ordinary atmosphere; and that one of the similarities between California and Chile, and one of the features which differ markedly from most regions in the world, is the fact that they are in the great Pacific volcanic belt above referred to. Now, volcanic outbursts mix the atmosphere with vomited gases, including abundant nitrogen gas. Conceive, now, the violent rains which follow volcanic explosions, due to the condensation of the water-gas emitted from the craters. These rains tend to clear the atmosphere, not only from water-gas but from the excess nitrogen and other gases, which they wash out from the air. These waters accumulate on the ground, and evaporate, or they sink into the rocks and evaporate; and thus boron, nitrogen, chlorine, and other gases are added to the soil and to the subsoil constituents.

Thus we may visualize two processes for the accumulation of the nitrate deposits of California—the emission of the volcanic gases, and the scrubbing of these gases from the air and into the soil by the rains which represent the condensation of the volcanic water-gas. But the data given in the Geological Survey bulletin show that these two processes have not completed the nitrate accumulations, and clearly show what has done this.

Caliche is a hard cemented surface soil peculiar to dry regions. One may find it widespread in Mexico without any valuable mineral content. Frequently, the cementing material is lime; whence the word *caliche*. The caliche is simply due to the hardening by cementation of a surface layer of soil or detritus, by the evaporation, on reaching the surface, of moisture drawn up through the soil or loose rocks by an upward capillary flow under the influence of hot desert suns. The cuts in the bulletin in question show that the nitrate-bearing caliche of California is beyond doubt of this origin, for the near-surface blanket of caliche covers reguluarly the outlines of the present hillocks, and so cannot have been due to the evaporation of standing water. Here, then, we have the third factor in the proposed theory of the accumulation of these California nitrate deposits—volcanic nitrogen, transferred to the soil by rains, later concentration at the atmosphere-rock contact and reaction zone by the "drawing" of the sun's rays. And, by analogy, we can recommend this explanation to those familiar with the Chilean deposits. It is a theory which covers borates in desert regions as well as nitrates; and, incidentally, some other salts and mineral deposits.

Wave Transmission of Power

MINE OPERATORS will be interested in a series of editorial articles, in recent issues of the *Engineer*, describing a comparatively new system of transmitting power by means of the vibrations of a liquid. The possible utilization of the method in connection with rock drilling suggests a brief discussion of the outstanding features. The inventor is George Constantinesco, a Rumanian, who also devised an interrupter gear during the war, which permitted the automatic firing of shots between the rapidly moving blades of an aëroplane propeller.

The wave system, as it is called, usually employs water as the transmission liquid, flexible-jointed piping being used to connect the generating apparatus with the rock drill or other machine doing the work. There is no direct flow or liquid; it merely pulsates to and fro, in consequence of intermittent compression and release. Contrary to common belief, water is elastic; it has proved a desirable medium for the transmission of power by the new method.

The wave generator is really a high-speed pump of special design. The transmission piping has a certain degree of flexibility, on account of the provision of movable joints. The rock drill contains the usual plunger, against the end of which the water is admitted. The drill is held in a chuck, and a rotary motion is secured by means of a bypassed portion of the water. a small amount of which is allowed to escape to the point of the drill and so prevents dusting. A water spring is used to insure the return of the hammer to its starting position. Comparative tests in competition with compressed-air drills have shown a considerable saving in power by the adoption of the new method.

Mining engineers will probably contend that a serious drawback is evidenced by the fact that the generator must be operated comparatively close to the drill; the need for frequent moving would constitute an objection. The connecting piping and its flexible joints are clumsy and heavy. The generator must be driven by steam, internal-combustion engine, or electric motor. The use of either of the first two is out of the question, and the electric motor is not altogether satisfactory as a source of power to operate portable apparatus underground. However, it is only fair to say that the published results of tests are such that the system cannot be dismissed as impracticable or uneconomical without a frank discussion by those who appreciate the need for increasing the mechanical efficiency and reducing the cost of mining underground. Our discussion columns are open to all who have comments to make.

The New President of the Institution of Mining and Metallurgy

THE WELCOME NEWS comes from London that Mr. R. Gilman Brown has been elected president of the Institution of Mining and Metallurgy. This will please his many friends in this country and the mining profession generally in the English-speaking countries, for Mr. Brown has been an exponent always of the highest code of professional conduct. He is a graduate of Dartmouth (class of '86) and of the Columbia School of Mines (class of '89); early in his career he was manager of the Standard mine, at Bodie, and had an office in San Francisco; as consulting engineer he was connected with many notable mines in Mexico and British Columbia. About fifteen years ago he went to London, at first in association with Mr. Oliver Wethered and later with Messrs. H. C. Hoover and Leslie Urquhart; he is now a director and consulting engineer of the Russo-Asiatic Consolidated and of other important companies. We doubt if any American engineer employed by British clients has upheld the honor of the American mining profession more consistently by sagacity of advice and integrity of conduct; he has kept himself apart from the share-peddling and company-promoting activities that have submerged so many mining engineers resident near Throgmorton Avenue; in short, he has stuck to his last and remained a true engineer. The Institution has chosen a standard-bearer worthy of its honorable traditions.

Radium and Rubbish

PRODUCERS OF CARNOTITE ore and radium will be interested to learn that a new application has been found for their product. In a recent issue of *Vanity Fair* we read an announcement, which emanated from the John Wanamaker store, to the effect that a golf ball with amazing proclivities is now for sale. When hit, we are told, "the radium salts in the plastic center start a wave of momentum which gives it a great resiliency. The ball literally is alive, and the released energy actually fights to free itself. Hard hit—it races yards farthest." Thus we learn that the game does not necessarily go to the adept, to the strong, or to the experienced, but to the one who can afford to patronize a high-class store to buy the ball with radium salts in the center. Alas for golf as a sport!

Why the new ball becomes alive only when hit is a mystery; there seems to be no particular reason why it should not start to move on its own accord before the player assists the work of Nature and industrial ingenuity. The organic world possesses many types that respond promptly to a blow, but we confess that this is the first instance that has come to our notice in which a sense of retaliation has been reported in what is usually considered as inanimate matter. It seems a pity that the new invention lacks luminosity. A great economic waste might be prevented if missing golf balls could be trained so that, before the great "wave of momentum" is spent, a modicum of the energy available could be converted into light and sound!

Magnetic Appliances in Mill and Treatment Plant

THE MAGNETIC SEPARATION of certain iron minerals from gangue constitutes an important phase of operations in ferrous metallurgy. The extended use of magnetic pulleys and mushroom magnets for the removal of tramp iron from ore going to crushers is an example of the direct utilization of magnetism in a manner that has proved effective and cheap. An additional use for this type of power is seen in distant control by means of magnetic clutches.

Those of us who have had experience with machines of high starting torque, such as ball or tube mills, will recall the trouble often experienced and due to end thrust and movement of the shafting, to slippage and firing, to the need for frequent adjustment, and to awkwardness of control. A large proportion of such mechanical troubles were attributable to the fact that the amount of preliminary overload was not anticipated, and clutches were provided that were too small for the purpose.

The push-button method of switch control of motors operating milling machinery is a step in the right direction, for it simplifies manipulation, permits quick action, and allows the operator to be protected from the results of electric sparking or short circuiting. Similarly, the distant control of machinery operated by direct connection with moving shafting is practicable by the utilization of magnetism as the force to hold together the friction surfaces of a clutch. In addition to the advantages of distant control and the reduction of accident hazard, magnetic clutches might well receive wider attention because of their simplicity and compactness. The limited field for synchronous motors in mills and metallurgical plants, due largely to comparatively small-scale operations, has doubtless restricted their use in the past, but it is interesting to note that magnetic clutches have proved successful in cement plants, in which the mechanical operations are somewhat similar to those that usually precede metallurgical treatment. It would seem that magnetic clutches would be suitable for use in the operation of pumps and other auxiliary apparatus in movable-leaf vacuum-filter and large-scale leaching plants, in which intermittent action is a feature.

The Institute and the Federated Societies

THE American Institute of Mining and Metallurgical Engineers has decided to withdraw its direct financial support from the Federated American Engineering Societies. A circular from the president, dated Nov. 15, so states; but it also adds (in effect) that the directors are willing to sponsor a continued connection between mining engineers and the Federated Societies through individual contributions of the Institute members for that purpose. Therefore the directors have sanctioned the appointing of a committee to receive contributions: it is not, however, an Institute committee, as we interpret the circular; it is a committee "representing friends of the Federated," and inferentially does not represent the Institute, which inferentially is dominated or controlled by those who are not "friends of the Federated." The reason given for the official withdrawal of the Institute is, however, an excellent and doubtless a true one—the lack of funds.

Last year the Institute cut down its previous contribution to the Federated Societies. Already there had been great dissatisfaction among the Institute members and governors on account of the disappointing results of the Federated Societies to date. The report of the Committee on the Elimination of Waste was condemned by the Board of Directors. That report, it will be remembered, laid most economic waste to the door of management (not labor), which scandalized the governorship of the Institute. Mr. J. Parke Channing, chairman of the unlucky committee, vigorously supported its conclusions; but the opposite thesis, that all economic troubles arise from the impudent extortions of labor, has since been consistently preached in the Institute organ.

Finally, the Federated Societies has trod on the toes of the Institute by deciding to publish a journal. The Institute governors disapprove of journalism by the Federated Societies; they have tried it themselves and know how far short of the promised results it has yielded. Moreover, there is the keen business competition—the competition for advertising—and the Institute is an advertising hound, so to speak; therefore, why should it help support a business competitor?

Aside from this, it must be confessed that the Federated Societies administration has been inept. It failed to take part in the question of engineer licensing, on which the Institute took so decided a stand; the divergence of opinion among the different engineering societies rendered the Federated Societies timid and negligible. A similar paralysis of timidity marked its action on other vital subjects. It failed to take positions, thinking to be diplomatic to all engineering interests involved; and behold it damned, by the mining engineers, for this very pussy-footedness. When it did take decided positions, it has been unlucky. It espoused the campaign for a Department of Public Works when Hoover was president; when Hoover became Secretary of Commerce, he ceased to support this movement. It embarked on a campaign, in opposition to the Mining Congress, against further War Minerals Relief legislation; it was a well-meaning and honest effort at public economy, and followed principles with which we are sympathetic; but the effort was diplomatically untimely, and hence was ineffective. The Mining Congress officials, cleverer at this game, are of the opinion that the opposition of the Federated Societies enabled them to put over the desired legislation. The Federated Societies has also offended by being too active in newspaper propaganda, and too lethargic in actual accomplishments.

And yet—since the Federated Societies represented a "splendid gesture," an idealistic ambition to make the engineer more useful to society, and society better by the engineer's knowledge, we should not welcome the weakening of the Federated by reason of the mining engineers' withdrawal. *Disapprobation of the conduct of a worthy organization is not a reason for withdrawal.* If it were, we should withdraw from the Institute, for the Institute governorship has been not only heedless but even antagonistic to an older institution—the independent mining journal—and that for very narrow and improper reasons. But we forgive the governorship for the sake of the membership; all is condoned in loyalty to the profession. If the Institute governorship lacks this broad and sympathetic loyalty, we cannot for that reason be drawn into any lessening of loyalty toward the Institute as a great aggregation of the finest men on earth.

Therefore we urge the members of the Institute to respond to the appeal of the committee and contribute through it to the Federated Societies. Do not expect to get your individual two dollars back with interest, but give with the feeling that you are for once in your life doing something for which you do not want to be directly paid—do it "as one who loves his fellow-man." We shall contribute our mite to back up our advice.

Having concluded as above, it will not be difficult to analyze the actual outcome. At two dollars or more a head, the number of Institute members who will actually subscribe will be relatively limited, and the total amount will be very much less than even the reduced contribution which the Institute voted last year. Then a few generous and devoted men will dig deep into their jeans, and the connection with the Federated Societies will be maintained for this coming year at least. We should like to have the committee let us publish the list of large donors. We can do it without blushing, as we cannot be among the number. In connection with this we wish to register admiration for the devotion of Mr. J. Parke Channing to this cause; for without him there would no longer be any cause for debate. He has given his time, his money, and his persistent energy freely for this ideal; and mining engineers will do well to back him up.

The Tellurides—III

By T. A. Rickard

IN NATURE the decomposition of the goldbearing telluride usually liberates the gold as native metal. The gold thus set free has characteristics that cause the oxidized portion of a telluride vein to be readily recognizable. At Mount Morgan, in Queensland, it was found in 1886 that the dull-looking gold would not amalgamate in the stamp-mill. Dr. Leibius, of the Sydney mint, decided, as the result of experiment, that the gold, which was of remarkable purity, was coated with an iron oxide. In 1893 I remarked the likeness between the gold of the famous mine in Queensland and the specimens given to me at the Pike's Peak and Garfield Grouse mines, at Cripple Creek; but it was not until 1897 that the resemblance was traced to a common cause—the derivation of the gold from calaverite and other goldbearing tellurides. The soft brown gold resulting from the decomposition of tellurides has the appearance of metal that has been precipitated from solution. At Kalgoorlie its pasty character won for it the name of 'mustard' gold. It occurs in splashes like yellow clay and is easily overlooked until a scratch burnishes it and thereby exhibits the unmistakable glint of the standard metal. At Cripple Creek lovely pseudomorphs of such gold after sylvanite and krennerite were found. In the Gold King mine patches of these pseudomorphs, or mineral replicas, were to be seen in 1899 in a series of quartz geodes, or cavities. The gold looked, as the miners said, "like splinters of rotten wood". At Cripple Creek the free gold usually has the appearance that marks the metal when it has originated from the disintegration of tellurides, but at Kalgoorlie the more usual form of brightly crystalline gold is common. Specimens spangled with minute crystals are found. Some of the native gold is so coarse as to retard solution in a leaching-plant and prevent successful extraction. At most of the cyanide mills at Kalgoorlie in 1897 it was found necessary to use supplementary amalgamating tables, over which the tailing was passed after discharge from the cyanide vats in order to extract any of these larger particles that had escaped solution. They would escape leaching not only on account of their size but because they lacked the spongy character possessed by gold that has resulted either from the decomposition of tellurides or from the similar decomposition that ensues from roasting in a metallurgical furnace.

Another, and rare, product of oxidation is tellurite, the oxide of tellurium. In 1877 a Dutch miner named Henry Neikirk, while prospecting in Boulder county, Colorado, drove his pick into a mass of soft clay-like unctuous stuff, and, on withdrawing his pick, he found that it was gilded. The mass consisted of a lemon-colored oxide of tellurium containing minute particles of amorphous gold, the two substances being products of alteration derived from the bronze calaverite that Neikirk found deeper down in association with magnesite and fluorite. This prospect became known as the Melvina mine. The di-oxide of tellurium, or tellurium ocher, has been found in Transylvania also; it is rare because its marked affinity for ferric salts causes it readily to form a definite compound, the tellurite of iron, to which I have referred already as being produced in the roasting of telluride ores.

The most valuable telluride is calaverite, the telluride of gold. It is named after the county of Calaveras, in California, the first determination of this mineral having been made by F. A. Genth on specimens obtained from the Stanislaus mine. The usual composition of calaverite is tellurium 56%, gold 41%, and 3% of silver as an impurity; it has a hardness of 2½ and a bronze-yellow to brass color; it has a resplendent luster and is one of the handsomest minerals ever disturbed by the miner's pick. At Kalgoorlie it glorifies the dull schistose rock with splashes of rich meaning. Analyses of specimens from the Great Boulder and Ivanhoe mines at Kalgoorlie show 42% of gold, with less than 1% of silver. The specific gravity is given as 9.377. At Cripple Creek good specimens of calaverite are comparatively rare; it occurs finely distributed through the ore and is obscured usually by sylvanite. Analyses of specimens from the Independence and Portland mines indicate a composition ranging between 38 and 40% in gold, with 3 to 4% of silver. The specific gravity is given as 9. In Boulder county, the Horsfall mine has yielded some fine specimens of calaverite. Miners find it difficult sometimes to distinguish this telluride from pyrite, because the difference in color is slight, but the streak of the former is yellowish gray, whereas that of the common iron sulphide is brownish black. The easiest test to distinguish them is hardness, calaverite being cut easily by a knife whereas iron pyrite is cut with difficulty; one is twice as hard as the other. The cubic crystalline habit of pyrite is another mode of differentiation, for calaverite rarely occurs in other than a massive form.

As calaverite is distinctively the telluride of gold, so hessite is the distinctive telluride of silver. This mineral, which is named after G. H. Hess of St. Petersburg, resembles argentite, the sulphide of silver, usually called 'silver glance' by miners. Hessite contains 62.8% of silver and 37.2% of tellurium, whereas argentite contains 87.1% of silver and 12.9% of sulphur. Both are sectile, that is, they can be cut by a knife, but argentite is the harder; both are steel-gray to iron-black in color, the silver sulphide being usually darker than the corresponding telluride. Fine specimens of hessite have been found in Boulder county, notably in the St. Joe mine. At the Golden Fleece, in Hinsdale county, Colorado, this telluride occurs in association with petzite, a gold-silver telluride, and in the Shoofly mine, in the La Plata mountains, it accompanies sylvanite, another gold-silver telluride.

Hessite is rarely found in a state of purity; usually it contains some gold, and thus gradates into petzite, which contains 41.86% of silver and 25.6% of gold, combined with 32.54% of tellurium. Petzite, named after W. Petz, a German chemist, is also steel-gray in color, but usually darker than hessite, and much more brittle. The Village Belle mine, in Boulder county, yielded a massive variety of this mineral, and in the Golden Fleece ore the petzite was so intimately mixed with hessite that it was difficult to distinguish them. Some petzite was found in the ore of the Geneva mine, on Gold hill, but this mineral is comparatively rare in the Cripple Creek district, so far as I know. It is the telluride most common in California.

Sylvanite is another double telluride of gold and silver; it contains a little more gold than petzite and

considerably less silver, its composition being 28.5% of gold, 15.7% of silver, and 55.8% of tellurium. Sylvanite is a beautiful bright silvery mineral. It is named after Transylvania, where, in the mines of Nagyag and Offenbanya, it was first found and mined as a rich ore. The best ore at Cripple Creek is characterized by the presence of sylvanite. I recall the 'Jeweler's Chamber' on the fourth level of the Independence mine, 23 years ago; this was a stope cut in a mass of magnificent telluride ore, which, owing to the brilliant luster of the sylvanite, shone in the candlelight like the cave of Aladdin. Sylvanite is readily distinguishable from petzite by its lighter color and its beautiful crystalline structure, to which it owes its other name, 'graphic tellurium', because the arrangement of crystals resembles Arabic lettering. It is softer than petzite. Sylvanite loses its silvery sheen by oxidation, and if the decomposition proceeds far enough to liberate the tellurium as an oxide, the gold that remains may retain the crystalline form of the original mineral—that is, the gold survives as a pseudomorph after sylvanite.

Lead has its telluride, altaite, which is named after the Altai mountains, in Siberia, where this mineral was first found in the Savodinski mine. It contains 62% of lead and 38% of tellurium; in color it is tin-white and its hardness is 3. Another telluride that contains lead is nagyagite, named after Nagyag, in Transylvania. This mineral usually contains a notable proportion of antimony (5 to 7%) and sulphur (8 to 10%), besides 56% of lead, 18 to 20% of tellurium, and 9% of gold. It is soft, the hardness ranging between 1 and 1½, and its color is lead-gray. Nagyagite has been found in the Olive Mabel mine, in British Columbia.

Nickel has a telluride named melonite, after the Melones mine in Calaveras county, California, where it was detected by Genth in 1867. It contains 23.8% of nickel and 76.2% of tellurium; the hardness is 3 and the color is reddish white. This redness is interesting, because the other tellurides that have been passed in review so far have colors like those of silver, steel, and lead. Another telluride is red—the telluride of copper. This was not discovered until 1902, although its occurrence in nature was suggested by the presence of tellurium in the anode slime from the electrolytic refining of copper at Butte and it would have been strange if a telluric compound with copper had not existed, seeing that so many other metals are found in this combination. By the way, the telluride of zinc remains to be detected. I became interested in seeking for the telluride of copper and caused many analyses to be made of telluride specimens from Cripple Creek and Kalgoorlie. Several of those from Kalgoorlie showed copper as an impurity in sylvanite and petzite, but no recognizable copper telluride was found, or has been found, either at Kalgoorlie or at Cripple Creek. In 1902, when riding across the San Juan from Ouray to Gunnison, I stopped at the Good Hope mine, at Vulcan. There I found a pyritic ore that contained native tellurium in masses as much as three inches thick; with these were associated small lenticular pieces of a purple mineral, the name of which was not known to the technical men at the mine. I made the test for copper and the test for tellurium, and discovered to my delight that the mineral reacted strongly for both; shortly afterward I took my specimens to Professor S. L. Penfield at Yale, and he, with Professor W. E. Ford, made a complete analysis, which showed that the mineral was the telluride of copper, and in a state so pure that its chemical structure could be determined—it was Cu_4Te_3. It was designated rickardite. Since then it has been found in several places, for example, at the San Sebastián mine, in Salvador. It contains 40.51% copper and 59.49% tellurium. The purple color of the mineral "rivals in intensity the deepest purple tarnish ever seen on chalcopyrite or bornite", as Professor Ford said; but this beautiful purple is not merely a tarnish, for even the powder of rickardite when finely ground is of the same deep color.

Bismuth's telluride is named tetradymite, from the Greek *tetradymos*, fourfold, on account of its rhombohedral crystallization. It contains 52% of bismuth and 48% of tellurium; it is soft, the hardness being 1½ to 2, and in color it is pale steel-gray. This telluride was the first of the species to be found in the United States —by C. T. Jackson in the Whitehall mines, near Fredericksburg, Virginia, in 1848. Since then it has been detected in North Carolina and Georgia, in association with the gold ores that are typical of the Appalachian region.

One more telluride remains to be mentioned—that of mercury, which is named coloradoite, having been found first in the Mountain Lion mine, in Boulder county, Colorado. It contains 62% of mercury and 38% of tellurium; the hardness is 3 and the color iron-black. Its luster, like that of its brother tellurides, is bright. Specimens that I obtained at Kalgoorlie had a peculiar brown tinge. An impure variety, containing gold and silver, has been named kalgoorlite, after the place of discovery, and another variety is named magnolite, from Magnolia, in Boulder county, Colorado. This is a tellurate, Hg_2TeO_4. The detection of these mercuric tellurides is easy, because of the fact that when heated they give a fume that readily condenses into globules of quicksilver.

Electro-Plating With Chromium

If claims, emanating from Sheffield, relative to a new method of electro-plating by the deposition of chromium upon iron, steel, copper, nickel, and brass by electro-deposition are well founded, the innovation is likely to modify profoundly the conditions of the cutlery, electroplate, and other industries in the future, according to *The Ironmonger*.

Chromium resists oxidation by air, water, and acids, and is harder and more durable than any of the metals at present employed as coatings for the prevention of rust. It is interesting to note that chromium is the element which is added to the furnace charge in the manufacture of stainless steels and irons. The new method is recommended for plating spoons and forks, hollow ware, knife handles, and many other articles of utility and of an ornamental nature. It is also suggested that "chromium-plating" may be used for rendering ordinary steel knife blades stainless. The metal is more expensive than the other plating metals, pure chromium being quoted at 4s. 9d. per lb. on the London market, but this, it is claimed, does not constitute a serious objection.

For a number of years research work had been carried on in England and in Germany to make possible the electro-deposition of chromium upon other metals, but had not hitherto been successful, because a suitable composition for the indicated plating solution could not be found.

DISCUSSION

Where Are the Miners?

THE EDITOR:

SIR—I have read with interest several articles of late appearing in your valuable paper regarding what has become of the old-time miners? Where are they and why have they left the mines? These questions have been written on by persons who were not qualified to do so. Some have been answered by persons that never put in a shift underground, others by men that have never left the mining camps. They have only quit the game temporarily. Most of them have either been outlawed or have been worked out.

I have followed the mining game for twenty-six years; that is, the rare metals, non-metals (excepting coal), and all the various metals. I have taken in most of the boom camps and all of the old camps that have been going since I have been in the game. I have worked from tool boy to superintendent, and therefore am qualified to answer these questions.

First, I want to thank ex-President Wilson for bringing the mining industry down to where it had to curtail production and lay off men by the thousands. That was the first time that an old-time miner was brought to his senses. Like the vast majority, I was under the impression that I could not do anything else but mine.

Now you ask why did they quit the game? This question is answered by the above paragraph. We were simply thrown out of employment. We quit for the simple reason that our pay stopped.

The question you should ask is "Why do they stay quit?"; that is what is bothering most of the operators today. Now, let me tell all the mine owners and operators in a fair and concise manner:

I am a miner, married, have four children and am trying to educate them and want to dress them as the average person demands to be dressed today. I want to live in a home, not a shack or cabin. I only want the average home for my family. In a mining camp I would be the only one that would be earning anything toward furnishing these necessities. I would be working for $5 a day. In most of the camps one works twenty-six days a month, that is $130 a month. I would have to work every working day to keep that up. There would be rent to pay, fuel to buy, water, lights, hospital fees, food and clothing. I am working for and supporting six people. There would be nothing in a mining camp for the rest of the family. The various state laws prohibit a boy from earning a salary in a mining camp, and then there is not employment sufficient to go around.

Today I am in Los Angeles. What am I doing? What are the rest of my family doing? Why do I not go back to the mines? It sums up as follows: I am working for a building company, am doing rough carpenter work and cement work; that is, building forms and pouring concrete. For this I am paid $6 per day. I can put in all the overtime I want (mining laws prohibit overtime). My oldest boy is working in a factory where he earns $21 a week, goes to a night school, and goes to day school every Monday morning. My girl is working in an office where she earns $18 a week and is learning a business, and goes to night school. I am not only working but am taking a course in night school as well as the kids. We are earning $324 a month. Our expenses are not a cent more than they would be in a mining camp. We have the facilities of a large city and do not have to go without anything.

Does this look as if I should return to old-time conditions? Is there not something wrong with the welfare conditions in mining camps? Have not the various mine managers been asleep on the job? The world is changing. Mine machinery of today becomes obsolete tomorrow. Living conditions change likewise. Why do they watch the changes in machinery and not in the welfare of their employees?

Another thing about mines and mining: Too many managers want too much of a man. I have been a shift boss in many places, and when a man comes in, puts in his round, tears down, and is ready to blast in five hours, the foreman or superintendent comes around and says, "Tell that man we want a 6-ft. round put in this drift." What happens? The company loses the best man they have working. There is only one company in Arizona and only a few companies in Michigan where a good man is wanted. The Phelps Dodge Corporation, in Bisbee, has the fairest bonus system ever put into effect, and it is not the greedy kind of corporation that generally exists. If a man does more work than his partner he gets more pay. There is a reason why he wants to do more and make every move count. Then, again, the P. D. people are not afraid to teach their employees. They employ bosses that lead their men and not drivers. Too many mines today are under the driving system, and their labor turnover is their largest cost item on the books. Any boss without brains can discharge a man for not doing a job according to Hoyle, but few bosses can teach a man to do the job properly. Today these same mines are hollering for experienced miners. I was in a Nevada camp recently and one foreman had discharged 263 men in the last two months. Where did this company gain anything by keeping such a man on the job? Yet he was the pride of the superintendent. I heard the superintendant say, "Old Blank doesn't fool with them. He is not afraid to tell it to them." Did that super ever pick up his pencil and figure out how much more the other foreman was worth? Can a man really give an honest day's work to such a foreman? Can a man bring his family into a camp where such conditions exist?

Today I realize that I am worth more to a mining company than I am to a building company or to any other kind of company, because I know every system of mining. I know what to do in case of an emergency, I know just what is expected of me and my boss. I know when I am in waste and when I am in good ore or poor ore. I not only know the game, but can teach

it to those that do not know it. Yet I have left the game, and I admit that many times I long for the smell of the underground workings where the sea breezes never blow. I get lonesome for the hum of the rock drill and the sound of the blasts as I am going from my working place to the shaft. After all, it is fascinating and it is hard to ween oneself away from it after many years with it.

Miners have to be made. They have to be made from the raw material; and it takes time to make them. Most foremen have not the time to teach them. Most of the shift bosses today are not teachers. The majority are just a little better than the average miner. Some are friends of the foreman. Some are good miners and some know absolutely nothing of the game. They can go through the mine and see if a fellow is wet with sweat, but they cannot tell what he has done, or under what conditions he did it. What the mines need today is bosses, and then the men will show up.

The old-time miner is worth just 60 per cent more than the beginner, and he is worth that every day for the first six months. Why not keep him? Why not make conditions such that he is sure of a job for the morrow? We all make mistakes, we all have to learn. Why cannot the mines and their operators learn this? Let them all get to teaching new men, as it is not right for one company to teach them and not the other ones.

Two years ago I was in New York City and met hundreds of miners in the big city following the subways. In Detroit I met miners every day in the auto factories. In Fort Wayne are numerous miners in all kinds of industries. The past year I have found miners in every city and hamlet of sunny California. Some are ranching, some are in factories, some in the building trades. Garages take a considerable number of them, and a lot of them are employed in stores. Very few are street-car employees, and less of them become salesmen or solicitors. They are found in all the iron works and steel mills. Shipyards have their quota from the mining ranks, while quite a number are trying to get by with a chicken garden. "TANGLE."

Los Angeles, Calif.

The Russo-Asiatic Agreement

THE EDITOR:

Sir—Since I wrote my editorial on the Russo-Asiatic agreement, the company has held its annual meeting in London, and Mr. Leslie Urquhart has received the thanks and hearty approval of the shareholders—indeed, he was given an ovation. In the course of his speech as chairman he said the following:

"Without this [technical] knowledge the equipment and, indeed, the properties themselves, are of secondary value, as has been shown by the Soviet Government's futile efforts to operate them. It has taken our technical organization of British and American engineers and metallurgists fifteen years of hard and intelligent work and the expenditure of many hundreds of thousands of pounds of British money to collect this vital knowledge and experience which went to build up and operate our great mining and metallurgical enterprise. This knowledge, without which the enterprise cannot be operated successfully, is ours and ours alone, and is in our sole possession; no one—whether Communist or capitalist government—can nationalize it without our approval."

This needs no comment; it is splendidly true.

San Francisco, Calif. T. A. RICKARD.

The Evils of Poor Management

THE EDITOR:

Sir—A communication from Mr. Arthur Thacher in your issue of Sept. 16, headed "Hiring and Firing," has recently come to my attention. It seems to me that it might be pertinent to call a little more attention to the fact that a great deal of improper firing is due to the improper hiring. Mr. Thacher seems to place more stress on the effect than on the cause; that is, he deplores improper firing without suggesting any other remedy as being of greater importance than that of taking length of service more into consideration. Undoubtedly, this should be done, but is there not something else that should be first taken into account, something more elemental, more vital, and still more important, both to the permanence of an organization and to the permanence of an individual's life within that organization?

In securing a stable and permanent organization, and the welfare of everyone within it, what is there to compare in importance with having competent officials? How can they be had unless they are rigidly trained in all details? What right has anyone to hold a responsible position unless he has proved in some measure superior to his fellows in understanding and strength? I apologize for referring to an axiom as old as humanity, but it is the old truth that the "stitch in time saves nine" which has the most bearing on stability of organization, and consequently on "Hiring and Firing."

The mining business has been and always will be more afflicted with ills of management, dosed with panaceas of organization, and possibly relieved by the cathartic of reorganization, than any other business. Mining continues to be regarded as so much a game of chance that ordinary truths may be disregarded. Again and again we see placed in responsible positions, even in well-regulated companies, men who have little right to occupy such positions; men untrained in fundamentals, men lacking the grasp that experience alone can give. Some of the best reasons that I have heard for selecting a manager are: he is the relative of a director; he is a nice, amiable fellow who can tell a good story; he is a wayward son for whom there is no other refuge; or, à la Katherine Blackford, that he may be fat, with a receding forehead and prominent ears. Any reason except his training and aptitude. Everything is left to Lady Luck, and away we go! In larger corporations it is quite natural that politics should play an important part and that men having especial political aptitude should reach important positions. It is, indeed, unfortunate when such an official's political talents outweigh his ability to grasp his work.

In larger organizations when a man does not fit, the whole organization becomes afflicted. There is such misunderstanding and consequent misrepresentation, both through lack of right fundamentals and through political necessities, that everyone loses grip on the situation. Bad mistakes are made and explained away. Everyone in the afflicted group becomes an expert at "passing the buck." The man at fault may be so ingratiating, so likable, so plausible in explanation, that mistakes are continually forgiven that could not be continually forgiven in others.

When such a condition arises, no one in the organization is safe. The organization itself is not safe. Then it is we see the troubles of "Hiring and Firing" at their worst. Something is wrong. What is it? No

one can place the responsibility. It is necessary to find a "goat." There is a "change in personnel." Now everything is as bad as before. There are more explanations. There are more changes. What is the trouble? Every employee is either wondering when the axe will reach his neck, or scheming over a way to evade it. And out of it all comes a sense of irritation, of unfairness, and of resentment, among the employees, that works havoc in any attempt to secure team work.

It is hard to say which is the worst of two evils: one where a good man is deprived of the right to select trustworthy assistants, or the other where a weak man is given wide latitude in placing his friends in responsible positions. In the same class as the latter might be classed systems where the employee's fitness for a given position is judged by purely physical appearance and based on his body and facial contours. The originators of such systems have based their systems on general truths long known to most people who have had much experience in human relationships. They have elaborated these systems, however, to a point where the average mind cannot follow the reasoning and the average eye cannot follow the distinctions made. Such systems are interesting and indeed may be helpful to executives already experienced in such matters, as a basis of comparison. In the hands of a youthful "employment expert," however, such treatises are just another method of playing with fire.

In such matters there is nothing to compare with the quiet, sane judgment of a capable man who has served a long apprenticeship. If he is capable himself he will select and should have the right to select capable and loyal assistants; he will prefer and make use of simple means in attaining efficient organization; and he will have a loyal organization machine.

In avoiding the evils that Mr. Thacher mentions we can still make most progress in training and then by tremendous care in selecting and combining thoroughly tried and competent men as officers. J. T. BOYD.

Cleveland, Ohio.

Electrical Prospecting

THE EDITOR:

Sir—With reference to my articles on "Electrical Prospecting," which appeared in the Oct. 7 and 14 issues of the *Engineering and Mining Journal-Press*, I should like to call your attention to a number of typographical errors which occurred therein.

In the issue of Oct. 7: In Fig. 2, the curve representing the profile of potential differences was not turned upside down when the map was so turned by the draftsman in your office, so that as printed it must be looked at from the north in order to avoid making the peaks appear as depressions and *vice versa*. In the legend the sections are "Looking S.W." not "Leaking S.W." In Fig. 7 the legend for profile No. 2 should read "North from main road E. of manager's house," not "Main road E. at manager's house." In Fig. 8 the legend for profile No. 1 should read "South across No. 5 vein at west end of trench," not "No. 5 vein of west end." In Fig. 1 the road going northwest across Potato Creek should be labeled "To Ducktown," not "To Dutchtown." In redrawing my original drawing of this figure, for purposes of reproduction, no provision was made for the fact that the original would be reduced, and hence a mere statement of the scale would be useless. For purposes of comparison, the school building on profile No. 9 is 150 ft. from the road, and the highest peak on the same profile is 150 millivolts, or approximately 3 in., above the line along which the profile was traced and which also serves as the zero line in laying off the ordinates, which are in millivolts. In the legend, "Profile at potentials" should read "Profile of potentials."

In the issue of Oct. 14, in Fig. 12 the legend should read "Point No. 1 of profile 12 same as point No. 12 of profile 6," not "Point No. 1 at profile 12."

I should like to call the attention of your readers to the fact that Professor Schlumberger's methods and instruments are patented in all the civilized countries.

Lawrence, Kan. SHERWIN F. KELLY.

The Near East

THE EDITOR:

Sir—I am afraid it is useless for me to point out the injustice of Mr. Mardick's unreasoning hatred of the Turks (p. 887, Nov. 18 issue). Of course, since he is an Armenian believing and hence under the influence of the tales regarding the massacres, his opinion cannot be classified as unbiased. Had it not been for the fact of its appearance in the esteemed *Journal-Press* I would ignore the vicious diatribe.

In answer it will suffice for me to quote a passage in the current number of *Asia* from the leading article contributed by Sir Charles Townsend. General Townsend ends his second paragraph with the following: "The Turk has had to deal with turbulent and treacherous peoples, and his way of dealing with them had the merit of strength at least. If the atrocities were totaled on either side of an account, we should find that many of the so-called Christian nations were deeper in bloodshed and guilt than the champion of Islam."

Brooklyn, N. Y. DJEVAD EYOUB.

An Accusation of Plagiarism

THE EDITOR:

Sir—I am sure all fair-minded readers will appreciate your editorial "A Plea for Credit" in your issue of Aug. 19. I suggest that you send a marked copy of it to Strauss W. Lloyd, who claims credit for "Taking a Solar Observation," in your Sept. 23 issue.

I suppose Mr. Lloyd felt perfectly safe in stealing an article twelve years old and which appeared in a magazine which ceased publication several years ago, so he went to the extent of lifting it bodily, even to using such sentences as "Although people should not make mistakes, they certainly do." To be sure, the "surveyor" of the original article has been promoted to an "engineer" by Mr. Lloyd, and whereas the original states that the observer would be so dazzled that he "could not recognize his wife's relatives," Mr. Lloyd picks the mother-in-law out of the lot as failing of recognition. Otherwise the thing is verbatim except for a change from "while" to "although," or some such similar alteration of wording.

The original article was entitled "Determination of the Meridian," and appeared in "Mines and Minerals" for June, 1910. The author is James H. Underhill, of Idaho Springs, Colo., author of "Mineral Land Surveying," an authority in his line and a man always ready to give credit where credit is due. LEROY A. PALMER.

San Francisco, Calif.

[The charge made by Mr. Palmer has been investigated and found to be correct. Mr. Lloyd's paper was lifted bodily from that of Mr. Underhill, without even the trouble of rewriting it being taken.—EDITOR.]

A Prospector's Thoughts

THE EDITOR:

Sir—I am a prospector of the class which, having read of the discovery of a bonanza lode, ask themselves: "Why not do likewise?" There ensues a hasty search for information in geology, mineralogy, and metallurgy through encyclopedia and public library, followed by a departure for the mining districts. Here the prospector finds that others have been before him. In proved districts, until he gets beyond a reasonable, visiting distance of stores, by careful search of unclaimed ground, he can find about a dozen deserted prospect holes to the square mile.

Has he not prepared himself to vamp the earth of its aurum? He begins to use his "dope." The earth shows evidence of at times having engendered considerable heat. Aurum coming into contact with heat, lime, and water, in the absence of iron, becomes a chloride not much heavier than the water. It floats away to find a resting place upon the bottom of the sea. Acids and alkalies in the soil dissolve, other metals leach back away to bear the aurum company. There is evidence that much which is now land was once sea-bottom. The thing to do is look for rock which was once sea-mud and try to find the concentrate of the metals underneath.

There are without doubt many more lodes of ore which have no prominent outcrop than there are which have, and the latter are investigated as soon as the territory becomes known mining ground.

A faint lead in the vicinity of ancient sea-mud rock, a pick and shovel with which to commune with nature for a period of months, or years, seems the quickest way for him to get a mine.

Oh yes; I have been here for a year and have uncovered a three-foot plus lode which pans a little aurum.

Mr. Steinmetz is civilizing in starting this discussion of the technic of religion and science. Is he not the first man who has dared attempt to put religion upon a technical basis of science?

The author of the article in your publication has already followed him "over the top" by getting rid of the bounds to our mental horizon, imposed by the infinite, by making clear that "it is the beginning and the end of finite time and space, of which the mind cannot conceive." There are consequently no bounds which can be recognized limiting our conceptions.

Is it possible that humanity is going to get rid of its "overhead expense" of bunk? A PROSPECTOR.

Venezia, Ariz.

Diatomaceous Earth

THE EDITOR:

Sir—May I call your attention to the frequent use in articles in some technical journals, of various trade names, which refer to the material known to commerce as diatomaceous earth? My company produces diatomaceous earth, and in fairness to all interested in the production of this valuable material I believe it should be referred to in technical and trade articles under its proper name, "diatomaceous earth."

Diatomaceous earth has also been known under the names of "infusorial earth" and "kieselguhr." I believe that "diatomaceous earth" is the most desirable usage, the material being composed of skeletons of diatoms. The use of the term "infusorial earth," in this connection, is incorrect, as the skeletal remains of infusoria are either absent entirely or present in an inconsiderable quantity. The name "kieselguhr" is of German origin, and is not descriptive of the material.

Los Angeles, Calif. NORRIS GOODWIN.

Prohibition and the Mining Industry

THE EDITOR:

Sir—With regard to the effect upon the mining industry of the Prohibition Act which came into force some years ago, in my opinion the results will vary with geographic location. For instance, I have two large mines operating, with some other business going on in California. I have asked the same question of the managers of these different enterprises, and they all vary so much that I could not use the information given, with any degree of satisfaction, and have come to the conclusion that the best way to handle this matter is to discuss it from my own viewpoint.

The great trouble is that there are so many different conditions facing the mining industry, at the present time, resulting mainly from war conditions. At the same time, the Prohibition Act went into effect during war conditions, and therefore it is difficult to separate it from other causes.

We do know this much—that labor is scarce. The miners of today are not as efficient as they were before the war—that is, the roving miner, the fellow that we call a "ten-day man." There are a lot of miners in California that roam around from mine to mine, working not more than ten days in one place, and I believe that this is brought about from the fact that they became dissatisfied during the war, due to war conditions. Wages were so high that it enabled them to work a few days in one place and accumulate sufficient money to enable them to pass on to the next job, see the country as it were, at the expense of the employer.

The old-time miner that stuck to his post during the war is the same old-time miner today that he was before the war. There is no alteration in his habits; if anything he is a better man today than he was before Prohibition became a law, but I believe that conditions have been made worse by Prohibition, so far as the roaming population is concerned, because these fellows, due to higher wages paid at the present time than before the war, are able to work a few days at a place, accumulate $40 or $50, pass on to the next job, buy bootleg on the road, and poison themselves to such an extent that when they are put to work at their next job they cannot even render a good account of themselves—not even a normally good account.

This question is a great big rambling one, and my candid opinion is that the country will eventually become a better country if Prohibition is absolutely forced upon the people, but during the process of making it a better country and a better people, there must be a period of great dissatisfaction—and we are passing through that period at the present time. Today there are no saloons at all. We do not seem capable of going part way, or taking half measures. We are either wet or we are dry. I think it was an absurdity that the Volstead Act was passed, because there was a way out of all this difficulty by closing the blooming saloons and placing restrictions on drinking houses that would legalize them, keep them clean and enable the people of the United States to drink pure spirits rather than bootleg material, such as they are poisoning themselves with these days. In place of that there is no legalized place to secure a wholesome drink, and the result is that there is on the market a material that is unfit for human consumption, but it is being consumed just the same at the expense of mind and life, to say nothing of broken health that is caused by using this poisonous stuff. W. J. LORING.

San Francisco, Calif.

Practical Manufacture and Use of Liquid Oxygen Explosive for Breaking Ore

Much of Real del Monte Company's Tonnage at Pachuca Broken With New Explosive Made on Spot — Germans Surpassed — Linde Oxygen Process Employed — Lampblack Carbon as Absorbent — Detonation by Cap and Fuse — Face Must Be Easily Accessible

BY A. D. AKIN

IN A MODEST, corrugated-iron building perched high up above the famous Loreto mill of the Real del Monte y Pachuca Company at Pachuca, Mexico, in which almost one-twelfth of the world's silver is produced, and almost on the very spot where tradition says the ancient inhabitants of Mexico worked the first ore of this famous district in prehistoric times, is situated a plant which is the parent in America of one of the most astounding developments of modern mining methods—blasting with one of the component gases of the atmosphere. The Real del Monte is a subsidiary of the United States Smelting, Refining & Mining Co.

It seems particularly suitable that this should be at Pachuca, for here has been the birthplace of many radical innovations in the mining industry, beginning with the *patio* process, invented and put into operation here in 1557 by Bartolomé de Medina. The first experiment with this process, which came to be so important to the mining world, was perfected but a few hundred feet from this insignificant building where the air is being broken down and called upon to give its latent forces to the rending of the earth that man may recover its treasures.

TWENTY-FIVE HOLE ROUND DETONATED EFFECTIVELY BY NEW METHOD

The fact that liquid air combined with a substance rich in carbon forms a powerful explosive has long been common knowledge, and many experiments along this line have been made in the United States and Germany, the highest technical development having been attained in the latter country. Even there to only a limited extent has the development reached the successful practical results obtained by the research department of the Real del Monte laboratories and which are now daily employed in practical commercial use in the company's mines. Considering the perfection to which this company has brought the process, all prior developments may be ignored, and this spot in a pocket of the Mexican sierras may be accepted as the birthplace of its practical commercial utility.

The first real attempts to utilize atmospheric elements as an explosive on a basis of commercial application were initiated by the "German Oxyhydric & Stock Co.," which attained such a degree of success that it was possible to load four holes with the oxygen-carbon cartridges and fire them before the explosive lost its detonating power. This primary development failed to be commercially successful on account of its limitations, but has been brought by the Real del Monte company so near to perfection that it is now possible to load and detonate a round of twenty-five holes without using undue haste in the operation.

The liquid oxygen used in the process by the Real del Monte company is produced by the Linde method, the mechanical equipment having been constructed from the inventor's plans. Operation has sufficed to show many particulars wherein the process may be improved and simplified, with attendant economies in initial cost and operation. The maximum pressure used in this process is 2,800 lb. The operation is in charge of a native laborer and an assistant, on each shift, which fact is a sufficient indication of the ease with which it is conducted. These men, or this man and a boy, give thorough satisfaction and demonstrate the degree of intelligence required. The power used is 100 hp., furnished by an electric motor. The output of the plant is thirty-six cans, each containing twelve kilos of 95 per cent pure liquid oxygen, per eight-hour shift.

The supply of raw material for the plant is drawn from the normal atmosphere, the carbon dioxide present first being extracted. The liquefaction is accomplished by the familiar method of gas expansion, multiple compressors with auxiliary refrigerating being employed in the process of attaining maximum compression. After the air is liquefied, it is reduced to a liquid oxygen, 95 per cent pure, by taking advantage of the fact that the temperature of ebullition of the nitrogen component of the liquid air is less than that of the oxygen. By this simple process of evaporation, or liberation of the nitrogen, which involves exposure at a degree of temperature at which the oxygen is safe from similar action, a satisfactory product is obtained, the refrigeration induced by the liberation of the nitrogen materially aiding in control of the oxygen in its liquid form. The resulting product is a bluish liquid, which, when poured from the container, resembles nothing so much as a polished bar of steel.

PURER OXYGEN LESS ECONOMICAL—MODE OF TRANSPORTATION

The Germans claim that they have obtained in their experiments a product containing 98 per cent oxygen, but this refinement has not been found necessary or desirable in practical use, as the oxygen over 95 per cent pure which is isolated at the Real del Monte plant gives the desired efficiency with attendant economy. To make a gas of higher purity would probably cost more without increasing the explosive efficiency.

This product, locally called "LO," is drawn off from the container used in the final process into metal cans of the thermos-bottle type, those in common use containing 12 kg. of the liquid. These cans are simply double-walled tin cans with cone tops, each top being surmounted by a neck, which is reduced by a bushing at the opening to an orifice about one-quarter inch in diameter. Through this small orifice the filling is done, five minutes being required to fill a can of 12-kg. capacity. This orifice is never closed, as its stoppage would result in an explosion, as would the presence of fire. The cans, stored on the floor awaiting transportation to the mine, disclose faint bluish wreaths escaping from the orifices, due to the exposed surface area, which is the determinative factor in storage of the gas. Under

the conditions existing at the Real del Monte, about 20 per cent of the LO is lost by evaporation before arriving at point of employment, but there is no weakening of strength of the available remainder, the loss being quantitative rather than qualitative. No special care is required in transportation of the LO, as in its unconfined and uncombined state its power is latent, and the worst that might happen is the spilling of it on some unlucky miner.

Greater Refinements of Germans Give Poorer Results

The German chemists have considered a refinement, beyond the point of the necessities of practical application, in the carbon as well as in the oxygen used in the explosive mixture. To this end, the carbon they use is made from cork, though practical demonstration has proved that there is no greater advantage gained by using it instead of the cheaper and more abundant grades of carbon, than there would be by the use of the highly refined oxygen previously mentioned. The only advantage assumed to be gained is in the prolonged life of the cartridge after being prepared for detonation, but the advantage of the increase of life so gained is doubtful, and the practical utility of it, if a fact, is likewise of questionable value. The life of the cartridge as prepared by the Real del Monte process is ample for practical use, and with all their refinement of materials, the Germans have not succeeded in attaining a cartridge life which would permit the loading of more than one-sixth the number of holes fired at each round by the Real del Monte in its daily use of the explosive. This fact alone makes any further discussion of the grade of materials hardly worth while and demonstrates the superiority of the American method and the suitability of the American materials.

This theoretical extension of detonating life implies greater rending power, based on a fixed unit of time elapsing from the moment of impregnation. This is the natural result of the primary quality of a higher ratio of absorption and consequent slower evaporation of the oxygen component of the impregnated cartridge. This does not imply that a greater quantity, in bulk, of the liquid oxygen necessarily has a lower evaporation, but the comparatively lower rate is due to the fact that the cartridge has but a fixed evaporating surface and the liquid oxygen a fixed rate of evaporation, resulting that the life of the cartridge depends solely on the ratio of absorption. Beyond a certain unit of time allowing for loading and detonation, this life has no practical value, and under certain conditions, such as missed holes, might be detrimental to the safe employment of the explosive.

Lampblack Used as Absorbent at Pachuca

In their commercial experiments, the Germans have used as a substitute for cork carbon, the use of which is prohibitive on account of scarcity and consequent cost, the lighter carbon products of petroleum and ordinary paraffin, the latter associated with tripoli to secure necessary porosity—the paraffin furnishing the carbon. These experiments have shown that when the tripoli-paraffin composition is employed, the best results are obtained from a mixture containing 40 per cent paraffin and 60 per cent tripoli. However, at Real del Monte the carbon product of petroleum in its more crude form has been found to give economically satisfactory results. The cartridge of this composition comes sufficiently within the requirement that the absorbing power of the carbon must be sufficiently great to store the oxygen necessary to insure a clean combustion of the carbon. This petroleum carbon, in the form of lampblack, made by combustion of *chapopote*, the residual gum of petroleum as found in the crude state in the Mexican oil fields, is used by the Real del Monte company in its practice. This is a very impure product, its absorption ratio being 4:1, as compared to the 4½:1 ratio of the higher forms of carbon employed by the Germans in their experiments, but since the happily combined mean of safety, efficiency, and economy seems to have been reached, there appears to be no necessity, even if an opportunity existed, for seeking a substitute.

Arrived at the point of loading, the explosive is prepared by immersing sticks of the carbon, above referred to, in deep, narrow cans of sheet metal into which the LO is poured when ready for use. These are commonly referred to as "soaking cans," and the operation is known as "soaking." This stick, or cartridge, of carbon is somewhat larger than a stick of dynamite, measuring 1.38 in. in diameter by 12 in. long, and its absorptive powers are such that it immediately takes up the LO in the proportion of 4:1, with the grade of carbon used. Withdrawn from the soaking can, it is then the liquid oxygen explosive, locally designated LOX, and is nothing more or less than an icicle in form. As fast as withdrawn from the bath, the sticks are placed in the holes, caps and fuse are inserted, and with but a promise of tamping the round is fired. It is interesting to note that the drill holes must be of ample size to allow for escape of gas while loading; otherwise the charge may be pushed out of the hole before detonation.

Firing Must Follow Loading Quickly—Charge Inert Within Twenty Minutes

From the instant of bringing the elements of the LOX into contact every move must be swift and certain to secure best results, as the power of the LOX depends on the ratio of the components, and under the influence of the greater surface exposed to evaporation the cartridges rapidly deteriorate by the evaporation of the oxygen, so that it is merely a matter of minutes before the charges are rendered inert. In the practice at Real del Monte, the holes are generally ready for firing in from eleven to twelve minutes after the cartridges are withdrawn from the soaking cans, and even at this time, assuming it as the instant of detonation, it has been determined that the cartridges have the relation of 65 gm. of carbon to 162 gm. of oxygen.

As the explosive effect depends on the relation of the elements, it is obvious that the earlier the operation arrives at the instant of detonation the more force is available. In this connection, it is not considered economical to detonate the charge, for breaking effect, when the ratio has passed below 2½:1, though detonation can sometimes be secured at as low as 1.75:1. Under conditions usually prevailing, the charge is considered inert after twenty minutes have elapsed after withdrawal from the bath, but a resoaking of the carbon sticks in the LO restores their life, and they may be treated as though under their primary impregnation.

Detonation by 8 Caps and Ordinary Fuse

The charges of LOX are detonated at Real del Monte by an 8x cap, which is the mine standard of that company, and common fuse. Electric detonation is probably better for some reasons in certain localities, and

is considered practically indispensable by the Germans, but the use of the ordinary fuse and cap has been found surest with the class of labor locally employed, and materially cheaper, the saving amounting to about 2½c. per hole. The actual firing of the round is identical in all particulars with the firing of a powder-loaded round.

The comparative value of the LOX has been found to be that a 1¼ x 8-in., 40-per cent gelatin cartridge, weighing 250 gm., is equal in power to a 35 x 300-mm. LOX cartridge, carrying 65 gm. of carbon and 162 gm. of LO at the time of detonation, the total weight being 227 gm. Economically considered, the LOX, as developed by the Real del Monte, costs, per ton of rock broken, 80 per cent as much as the 40 per cent gelatin powder for identical results.

The extent of its use by this company is governed only by the class of work involved. This factor is comprehended in one word: accessibility. The employment of LOX necessitates having reasonably easy access to the face, so that the transportation of the carriers and soaking cans may not involve too much time and labor, not only in bringing them up to the face to be loaded, but also in clearing away for the shot, as time has already been demonstrated to be an important factor in the effective use of the explosive. This condition prohibits the use of LOX, as now made, in upraises and other workings difficult as to access and clearing away, more particularly the latter, as these are the only limiting factors of its use.

In the Rosario mine of the Real del Monte company, which is now (October, 1922), producing 12,000 tons per month, 90 per cent of the breaking is done by LOX. Except for the limiting conditions mentioned, it is therefore evident that all of its ore would be broken by this explosive. At the Camelia mine, producing 700 tons per day, 50 per cent is broken by LOX, with the same exceptions.

Of course, initial economy, as cited in the comparative costs given, is generally a ruling factor in all commercial operations, but in the use of this explosive another important feature of economy is presented, in that no noxious gases are produced by its action, and picking down of the broken face and mucking out may begin as soon as the dust settles, thus affording an appreciable saving of time in continuous operation. The avoidance of delay in approaching and reloading missed holes with absolute safety cannot be ignored, as the lapse of twenty minutes from the time of withdrawing the impregnated cartridges from the soaking cans insures sufficient evaporation to render them inert, and they may then be withdrawn, resoaked, primed, and are ready for detonation. Any mining man who has had experience with delayed shots, oftentimes grewsome in their consequences, will particularly appreciate the mental relief afforded by this safety factor. There is also no chance of leaving dead charges to be picked into by the shovelers.

Aside from these economic and safety features, there is the further factor of safety in storage, as the volatility of the LO effectually prevents its storage, and the carbon, by itself, is not dangerous. The components in transport offer similar security and are absolutely insensible to low atmospheric temperatures. The developments at the Real del Monte indicate that the machinery producing LO may be simplified to such an extent that it will soon be possible to make this cheap and safe explosive available for mines of comparatively small capacity.

Manganese Dioxide Produced by Chemical Process in California

BY GEORGE J. YOUNG

The American Manganese Products Co., of Redwood City, Calif., was established over a year ago and has been perfecting its methods for the treatment of raw manganese ores. This company was formed by the Winship estate, which owns eighteen or more manganese mines. These mines are small and have been leased to various operators, who ship their ore to the plant owned by the company named.

The mineral is manganese dioxide. The ore is ground fine, followed by digestion with a sulphurous-acid solution and air, the manganese going into solution as manganese sulphate. The solutions and residues are transferred to a settling tank, the coarse particles are settled, and the solution and suspended material are filtered by means of an Oliver filter, removing silica and other solid matter. The clear solution is then treated with calcium nitrate shipped from Norway to California in 200-lb. wooden barrels. The manganese is thus changed from the sulphate to the nitrate, the calcium being precipitated as calcium sulphate. The copper in the solution is then precipitated by means of aluminum dust. The resulting solution is evaporated in open pans, the calcium sulphate separating out.

The solution is next filtered and then evaporated under vacuum. The manganese nitrate is heated in retorts and dissociated into manganese dioxide and nitric acid, the acid being recovered by scrubbing towers in series. The first tower produces a nitric acid of 1.38 sp.gr., almost chemically pure, which it is proposed to use for the manufacture of lead nitrate. The manganese dioxide is also almost chemically pure. Attempts have been made to market this product in the dry-battery industry, but apparently the physical condition of the dioxide is not entirely satisfactory, although its purity meets the requirements. Phillipsburg, Mont., supplies the dioxide to the dry-battery trade.

Although the plant has been producing on a small scale for a year, little manganese dioxide has been marketed and that only during the last three months. Efforts are now being made to find a market for the product, which appears to be especially adapted to the demands of chemical manufacturers and glass makers, and as a coloring pigment for cement pavements and other uses where a pure, high-grade dioxide is required. The process used has been patented in the name of E. H. Westling, and the patents have been assigned to the company.

Prospects in Similkameen District, B. C.

In the Similkameen mining district, in British Columbia, are situated several promising low-grade copper and gold properties and a number of higher-grade silver-lead prospects. Among them is the Summit, at the head of the Tulmameen River; this is an old mine on which some development has been done, but little ore has been shipped, owing to transportation difficulties. With the improvement of the road from Tulameen village on the one side and Coquihalla valley on the other, there was every chance of the opening of mines of some importance. A number of properties in the vicinity of the Nickel Plate mine, containing similar ore, may be developed in the near future.

The Production of Caustic Calcined Magnesite in the Scott Furnace

Apparatus Used in the Distillation of Quicksilver Proves Readily Adaptable in New Field, Despite Much Higher Temperatures Essential—Has No Movable Parts and Is Virtually "Fool-proof"

By W. C. Riddell and C. N. Schuette

THE SCOTT FURNACE was invented and first used at the New Almaden quicksilver mine, in California, in 1875. It is a roasting furnace, and was developed to treat fine ore. Previous to its introduction, coarse lump ore and briquets (adobes) were treated in simple shaft furnaces of the lime-kiln type; since its invention, it has been the premier furnace used in the quicksilver industry of America.

In the summer of 1917 a small (two-shaft, two-tile) Scott furnace of the Kings Quicksilver Mining Co., Ltd., of Kings County, Calif., was used experimentally by the King Magnesite Co. to calcine magnesite from the company's near-by mine. Early in 1920, C. S. Maltby built a large (four-shaft, four-tile) Scott furnace on the property of the Maltby magnesite mine, near Livermore, Alameda County, Calif. This furnace has been in successful operation for the last three years. This article, written with the consent and cordial co-operation of Mr. Maltby, presents for the first time the results obtained with this type of furnace in the production of caustic calcined magnesite.

The furnace referred to in this article is illustrated in Figs. 1 and 2. The Scott furnace presents the appearance of a quardangular prism of masonry. Its greatest dimension is height. The width of the furnace is determined by the width of the ore shafts, and the thickness depends on the number of ore shafts. These

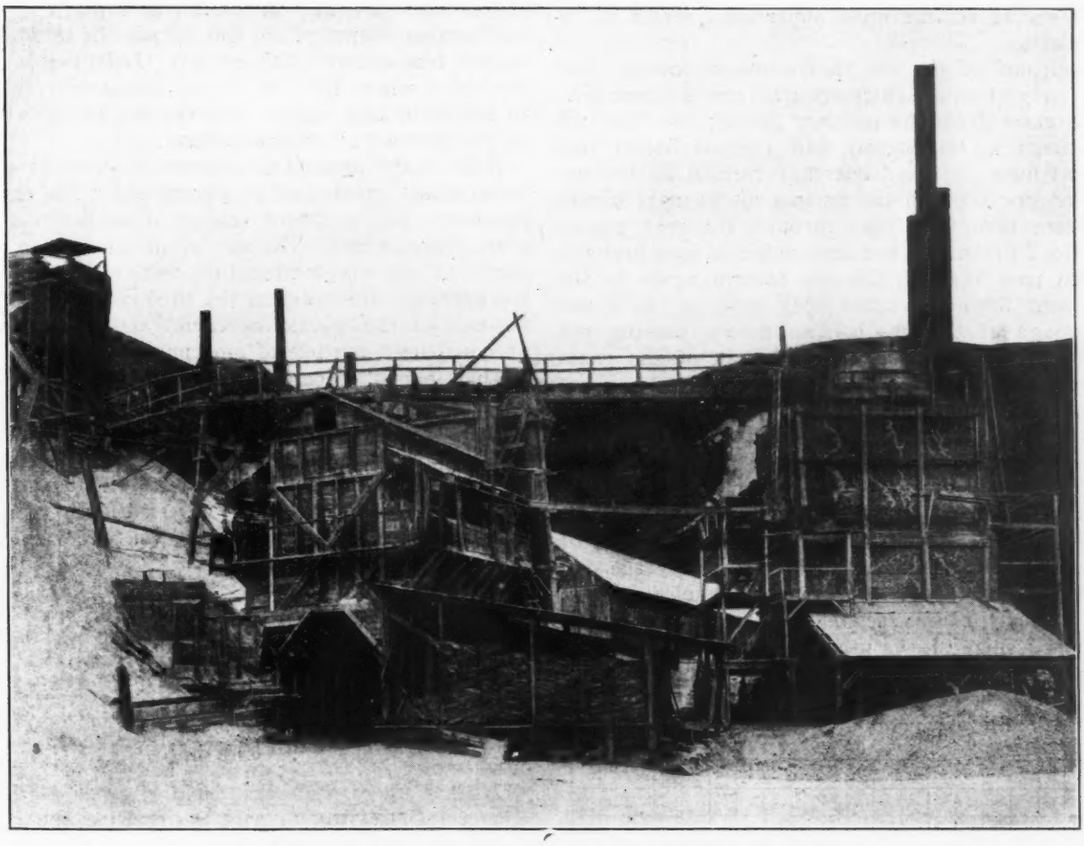


Fig. 1. Calcining plant. Maltby magnesite mine

furnaces are built in sizes containing from two shafts, two tiles wide (each tile measuring 3 ft.), to six shafts, five tiles wide, and are designated by these factors. The height is about 40 ft. for all furnaces.

The ore shafts are fitted with staggered tile shelves inclined at 45 deg. and so placed that the space between successive shelves (the shelf slit) is from 4 to 6 in., according to the depth of ore bed desired. The ore is charged at the top through an expanding throat and is discharged at the bottom through doors in the side walls. From top to bottom the ore in the furnace

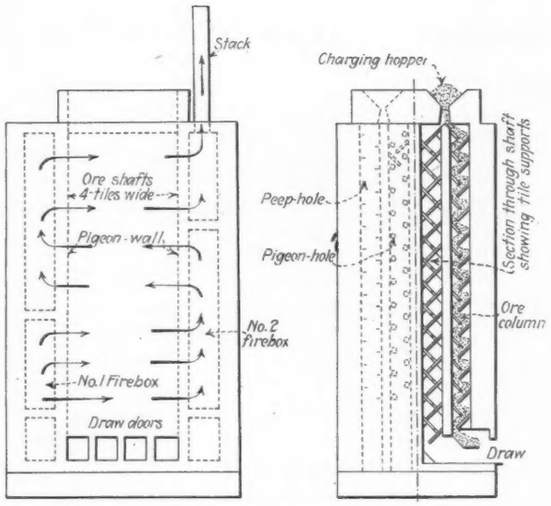


Fig. 2. A four-tile, four-shaft Scott furnace

forms a zigzag column on a superposed series of inclined hearths.

On each end of the ore shafts and separated from them by a perforated (pigeon) wall are the fireboxes. The fuel gases from the primary firebox pass through the openings in the pigeon wall (pigeon holes) into horizontal flues (inclined hearths) formed by the ore column on one tile and the bottom of the next higher tile. From here they pass through the rear pigeon wall to No. 2 firebox, ascend until deflected by a firebrick arch, and pass through the ore column again to the upper front firebox, whence they make a third and final passage of the ore column before passing out through the stack. This S-shaped path of the gases approximates a countercurrent flow.

The outer end walls of the furnace have peep holes, registering with the pigeon holes, so that the operation can be observed and so that rods can be introduced to loosen possible hang-ups.

The cost of a four-tile, four-shaft furnace varies between $15,000 and $20,000, depending on the cost of the concrete work, the brick, and particularly the distance over which the material must be hauled.

Two products of magnesite are used in the arts. Dead-burned magnesite is used as a refractory furnace lining and caustic calcined magnesite is used for Sorel cement. Dead-burned magnesite is prepared by calcining in stack kilns or rotary furnaces at temperatures

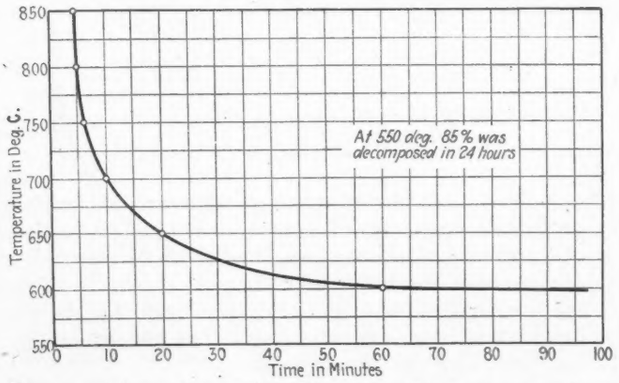


Fig. 3. Time of complete decomposition of amorphous magnesite at various temperatures. Size of particles 28 to 35 mesh, Tyler standard screen

between 1,400 and 1,600 deg. C. Dead-burning is essentially a process for changing the alpha form of MgO to the beta form, or periclase. Pure periclase has a higher specific gravity than any other form of MgO, and therefore, when used as a refractory, the least shrinkage. The oxides of iron, aluminum, and the alkaline earths have the property of catalyzing this reaction from the alpha to the beta form, and ferric oxide is the best of these catalyzers. For this reason high-iron magnesites are used preferably for dead-burning and a majority of the ferromagnesites contain about 7 per cent Fe_2O_3.

The burning of caustic calcined magnesite is carried on within a limited range of temperature and requires careful regulation of the time-temperature factor. The most favorable temperature range is between 700 and 850 deg. C. The composition of the magnesite must be considered, as an appreciable content of iron oxide necessitates greater care in the calcining process. With a pure low-iron magnesite, such as that from the Maltby magnesite mine, a higher calcining temperature can be used, with a corresponding decrease in the time of treatment. This favorable factor can be utilized to increase the tonnage output of any one furnace by maintaining a higher temperature (but not over 1,000 deg. C.) up to the point where the cost of the additional fuel needed to maintain this higher temperature offsets the value of the increase in tonnage output.

Aside from impurities, magnesite deposits differ in being either crystalline or amorphous. The crystalline magnesite has a slower rate of decomposition at any given temperature. The rate of decomposition of magnesite at any one temperature varies with the size of the particle. Here, again, the time required for decomposition of the crystalline variety is greater than for an equal-sized particle of amorphous magnesite.

The time of decomposition of 28- to 35-mesh amorphous magnesite is shown in Fig. 3, and Fig. 4 shows the effect of particle size on the rate of decomposition of both varieties. The curves show that effective calcination begins at approximately 700 deg. C., and that a smaller particle size lowers the time factor of calcination. Typical analyses of the two varieties are given below:

	Amorphous Magnesite from California	Crystalline Magnesite from Washington
SiO_2	1.20	7.65
Al_2O_3	0.15	0.30
Fe_2O_3	0.13	0.70
CaO	0.70	0.03
MgO	46.60	43.50
CO_2	51.70	48.00
H_2O	0.02	0.08
	100.50	100.26
Equivalent $CaCO_3$	1.25	0.05
Equivalent $MgCO_3$	97.90	91.30

Operation of the Scott Furnace

The crude magnesite is crushed to pass a 1½-in. screen before being charged to the furnace. The operation of charging consists of dumping the crushed rock from a car into the hopper above the furnace throat, whence it descends as the calcined product is withdrawn below. About one ton of caustic magnesium oxide is drawn out at hourly intervals, and the amount charged is about two tons, the loss of carbon dioxide accounting for the difference in weight. The operation of drawing consists of raking the calcine from the draw-plates into cars at the side of the furnace. Then another ton of calcine is drawn down on to the draw-plates from the lowest tier of tile. Here it is left to cool for one hour. The temperature of the freshly drawn material is about 480 deg. C. and this cools to

about 150 deg. C. before being drawn into the cars. The heat lost by the cooling calcine is utilized in large part to pre-heat air passing into the furnace through the draw doors, the draft being strongly inward at this point. Sheet-iron doors are provided to regulate this inflow of air. Different draw periods, ranging from thirty-five to seventy minutes, were tried, and a sixty-minute period was found to be the most satisfactory.

Oil, atomized with steam, is used for fuel. Various types of burners arranged in different ways and at different places were tried. The most effective arrangement found is now in use, and consists of two opposed burners giving a short flame in the primary firebox, and one burner in No. 2 firebox.

The temperature is closely controlled. Thermocouples are permanently installed in No. 1 and No. 2 fireboxes, the temperatures being recorded by a Thwing electrical recording pyrometer. A chart of this instrument showing how closely these temperatures are regulated is reproduced in Fig. 5. The average temperature in No. 1 firebox is 1,093 deg. C. (2,000 deg. F. on chart),

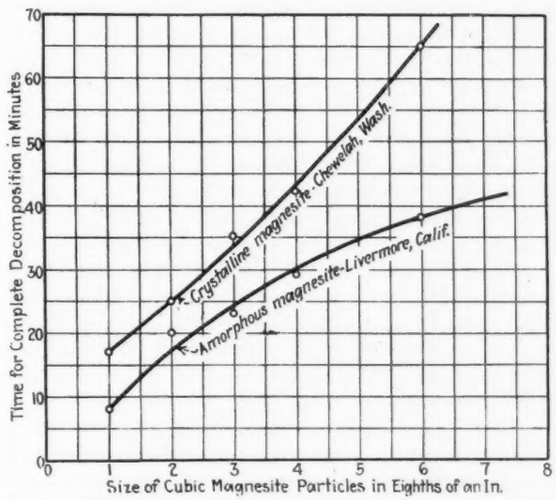
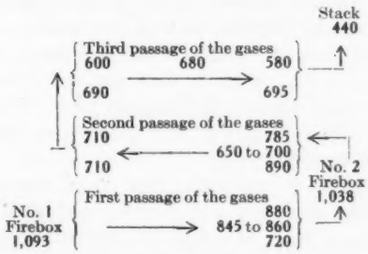

Time for Complete Decomposition in Minutes
Size of Cubic Magnesite Particles in Eighths of an In.
Crystalline magnesite-Chewelah, Wash.
Amorphous magnesite-Livermore, Calif.

Fig. 4. Effect of particle size on rate of decomposition of magnesite at a constant temperature of 750 deg. C.

and the temperature of No. 2 firebox averages 1,038 deg. C. (1,900 deg. F.). A five-point Thwing indicating instrument is used to take periodic readings at other significant points. The stack temperature varies between 425 and 455 deg. C., the average being 440 deg. C. (825 deg. F.).

A temperature traverse of the furnace was made with an iron-constantan couple protected by an iron pipe, and a Leeds and Northrup potentiometer. The temperature of the rock on the tile was obtained through various peep holes. This measured the temperatures 3 ft. inside the pigeon walls. The results of this traverse are given below:



The striking feature brought out in this diagram is the maintenance of this high temperature over so large a vertical height of the furnace and the uniformity of the temperature maintained. It is a striking indication of the heat control which it is possible to obtain in a Scott furnace.

Before equable conditions of operation were obtained, the fuel consumption was sometimes as high as 40 or even 50 gal. per ton of calcined material, with a daily production of about 24 tons. Since then a better understanding of the process, together with close temperature control, has resulted in effecting an economy in fuel. In the thirty-one days from July 1 to July 31, 1922, a total of 25,530 gal. of oil was burned in the furnace. In this time 675 tons of magnesite was produced, the daily tonnage varying from 21 to 24. This gives an average fuel consumption of 37.7 gal. per ton of caustic calcined magnesite, and an average output of 21.8 tons per day.

Calculation of the Furnace Gas Volume

Fundamental data:

	Per Cent Furnace Feed	Per Cent Furnace Draw
a. Average chemical analysis:		
"Insoluble"	2.50	4.90
Alumina, Al_2O_3	0.30	0.50
Ferric oxide, Fe_2O_3	0.25	0.42
Calcium oxide, CaO	1.25	2.45
Magnesium oxide, MgO	45.30	89.10
Carbon dioxide, CO_2	50.50	2.50
Water (110 deg. C.), H_2O	0.15	....
Total	100.25	99.87
b. Average stack gas analysis:		
Carbon dioxide, CO_2		16.00
Oxygen, O_2		7.00
c. Fuel (California crude oil) analysis:		
Hydrogen, H_2		11.5
Carbon, C		86.5
Nitrogen, N_2		0.8
Sulphur, S		0.7
Total		99.5

14 deg. Bé. weight 8.03 lb. per gal.
Heating value, 18,500 B.t.u. per lb.
On the basis of 37.7 gal. per ton, the fuel consumption is 302.7 lb. per ton (2,000 lb.) MgO produced.

d. Air for combustion and excess air assumed to be one-half saturated with water vapor at 20 deg. C.

e. Calculating from boiler feed water and number of burners, the steam needed to atomize the oil is about one-third, by weight, of the oil used.

The carbon of the fuel burns to CO_2. Then $302.7 \times 86.5 \times \frac{44}{12} = 960$ lb. CO_2 will be formed per ton MgO.

Total CO_2 per ton MgO:

	Pounds		Per Cent
From fuel	960	or	34.2
From $MgCO_3$	1,846	or	65.8
Total	2,806		100.0

The average CO_2 content of gas leaving the furnace is 16 per cent. Of this $0.16 \times 0.342 = 5.47$ per cent is derived from the fuel.

The oxygen consumption corresponding to the formation of 5.47 volumes CO_2 is $\frac{3}{2} \times 5.47 = 8.20$ volumes.

The nitrogen accompanying 8.2 volumes of oxygen equals $\frac{79}{21} \times 8.2 = 30.8$ volumes.

Now, the excess air can be calculated by difference:

	Volumes
C_2O from fuel	5.47
N_2 in air consumed	30.80
Total	36.27
Excess air by difference	63.73

The total volume of air entering the furnace corresponding to 100 volumes of gas leaving the furnace, exclusive of moisture, then was:

	Volumes
Oxygen for combustion	8.20
Accompanying nitrogen	30.80
Excess air	63.73
Total air	102.73

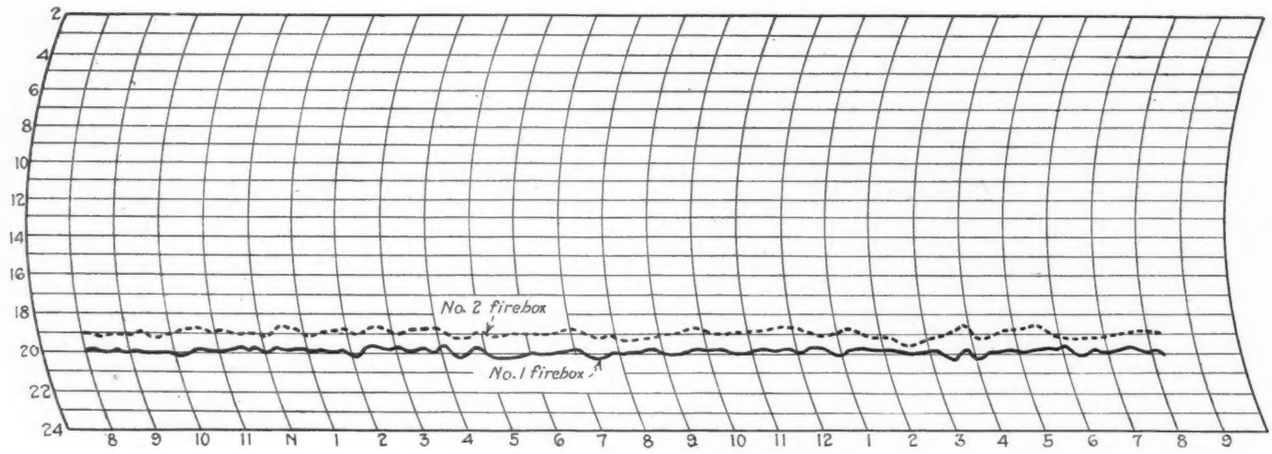


Fig. 5. Temperature record for twenty-four hours

Ratio of total air to necessary air equals $\frac{102.73}{39} = 2.63$.

Then the excess air entering the furnace is 163 per cent.

Components of the gas leaving the furnace per ton MgO:

		Pounds	Pounds
Carbon dioxide	from fuel	960	
	from magnesite	1,846	2,806
Water	from combustion	313	
	from steam	101	
	air	87	501
Nitrogen	from air for combustion	3,270	
	from excess air	5,340	8,610
Oxygen	from excess air	1,590	1,590
Total			13,507

Furnace gases per ton of calcined MgO:

Substance	Weight in Lb.	Cu.Ft. per Lb.	Volume in Cu.Ft. at Standard Conditions	Per Cent Volume
CO_2	2,806	8.15	22,800	14.2
H_2O	501	19.90	10,000	6.2
N_2	8,610	12.77	110,000	68.5
O_2	1,590	11.21	17,800	11.1
	13,507		160,600	00.0

Gas Volume

A total of 21.8 tons of MgO is produced per twenty-four hours.

Then 21.8 × 160,600 = 3,490,000 cu.ft. is the daily volume of gas discharged from the furnace as measured at 0 deg. C. and 760 mm. barometric pressure.

Heat Balance Per Ton (2,000 Lb.) of MgO Produced

Fundamental data:

Fuel value of the oil, 18,500 B.t.u. per lb.
Specific heat stack gases at a mean temperature of 230 deg. C. = 0.2557.
Specific heat MgO at mean temperature of 85 deg. C. = 0.24.
Heat of decomposition of $MgCO_3$ per lb. of MgO:

	B.t.u. per Lb.
DeFrocrand	1,290
Thompsen	1,200
Average	1,245

Heat input:

	Per Cent
302.7 × 18,500 = 5,600,000 B.t.u.	100

Heat outgo:

	B.t.u.	Per Cent
Calcining, 2,000 × 1,245 =	2,490,000	44.5
Stack gases, 13,507 × 0.2,557 × (825–70) =	2,600,000	46.5
Draw, MgO, 2,000 × 0.24 × (300–70) =	110,000	1.9
Radiation, convection, etc., (by difference) =	400,000	7.1
	5,600,000	100.0

The heat balance indicates a loss by radiation and convection of 7.1 per cent and a fuel efficiency of 44.5 per cent. Stack kilns in general have a fuel efficiency of about 40 to 45 per cent; rotary kilns rate lower at 25 to 35 per cent. The Scott furnace, then, with a fuel efficiency of 44.5 per cent, offers a decided advantage over the rotary kiln. It compares favorably with the stack kiln in fuel efficiency, while calcining material too fine for stack-kiln treatment.

The outstanding difference in the use of the Scott furnace in treating quicksilver and magnesite rock is the much higher temperature needed in the latter work. In treating quicksilver ore the furnace temperature decreases evenly from about 800 deg. C. at the bottom to 200 deg. C. near the top, whereas in magnesite work, a top temperature of 600 deg. C. is maintained. In high-temperature work, the pigeon wall of the Scott furnace becomes the weakest structural part. Small amounts of dust sifting into the fireboxes through the pigeon holes form a fusible magnesia slag. These pigeon holes must be kept clean and the firebox temperatures must be kept below the point where, aided by the magnesia slag, a melting of the pigeon wall would result. The stack temperature is high, but the heat lost there could be utilized for pre-heating the rock by building a higher furnace. This cannot be done in quicksilver work, as the gases there must pass to the condensers above the "dew point" of mercury vapor.

The advantages of a Scott furnace are largely due to its "fool-proof" nature. It can be operated entirely by unskilled labor, and the absence of movable mechanical parts is of particular advantage in isolated plants where shop facilities are meager. Draft, temperature, and rate of feeding can be closely and easily controlled within the desired limits, and the fuel efficiency is high. Every part of the furnace is accessible to the proper tools and inspection, and maintenance charges are moderate. In quicksilver work, a shutdown of a Scott furnace generally implies lack of ore rather than necessary furnace repairs, and at least one Scott furnace has a record of twenty years' uninterrupted operation. As against a rotary kiln or McDougall type of furnace, the Scott, aside from fuel efficiency, has the advantage of producing little or no dust.

In conclusion it may be said that the use of the Scott furnace for the production of caustic calcined magnesite is a good example of the intelligent application of an apparatus tried and proved in one process, to a new process with similar requirements.

Non-Metallic Mineral Wealth of Russia*

A Résumé of the Country's Resources—Production Important Before War —Petroleum Reserves Great—Country Formerly Ranked High as Producer of Salt and Asbestos—Numerous Occurrences of Other Metals and Minerals

BY SYDNEY H. BALL

AT SOME FUTURE DATE Russia again will take her place as an important producer of minerals. When, no one knows, but with the political situation such as it is, an outline of Russia's non-metallic mineral wealth is opportune.

European Russia is geographically linked to Germany, and it is natural that eventually the technical skill and machinery, and even perhaps the capital to develop new enterprises in Russia, west of the Urals, will come largely from Germany. The pre-war interdependence of the two countries is indicated by the fact that in 1913 over 38 per cent of Russia's trading was with Germany, 29 per cent of her exports going to Germany, and 47 per cent of her imports being of German origin.

As to Siberia, European countries are not as favorably situated, and there, at least, American financiers and technicians should be in an advantageous position. America's financial resources, her experience in developing the analogue of Siberia, our own West, and the traditional friendship of the Russian and American peoples, all bespeak the propriety of America's participation in Russian, and particularly in Siberian, development.

At present, participation in Russian enterprises is inexpedient. Mining enterprises cannot be re-established or developed until the right of foreigners to hold property and the right to conduct private enterprises without government interference is recognized, and until the safety of foreigners is assured by the creation of a stable and just system of government and laws.

Before the fall of the monarchy, non-metallic mining was no less undeveloped than other Russian industries were, transport before the war being inadequate even in European Russia for any but high-priced mineral product; and in Siberia conditions were more or less comparable to those in western America in the 70's. Were Russia's mineral wealth developed, however, no other country, not even America, would be more self-contained, so far as minerals are concerned. Her coal, because of transportation conditions, is available only to herself and her immediate neighbors, but her oil fields will become legitimate centers of investigation by American capital. The asbestos deposits are large and produce high-grade fiber, and at some future time the manufacture of portland cement should again become highly profitable.

Statistics as to Russian mineral products are admittedly incomplete; those herewith presented are obtained largely from *Mineral Resources*, a publication of the U. S. Geological Survey, although some are from *Mineral Industry* and other sources.

Non-metallic minerals were produced in Russia in 1913 to the amounts given in Table I. The value of the products named probably approximated $150,000,000, or one-tenth the value of the non-metallic minerals of the United States for the same year.

*For résumé of Russia's metallic wealth see article by S. H. Ball and Bela Low in *Engineering and Mining Journal*, March 10, 1917.

The imports of non-metallic minerals into Russia exceeded in value the exports, the principal items on the import list being coal and coke, although sulphur and Chilean saltpeter were also important items. The chief exports were crude oil and oil products.

TABLE I—RUSSIA'S NON-METALLIC MINERAL PRODUCTION IN 1913

Coal, short tons	35,500,674
Petroleum, barrels	67,685,000
Salt (1912), short tons	2,220,000
Portland cement, short tons	2,333,000
Asbestos, short tons	19,284
Peat, short tons	5,510,000
Natural gas, M. cubic feet	4,000,000
Phosphate rock, short tons	27,558
Potash, short tons	20,000
Asphalt (1910), short tons	27,544
Glaubers salt, short tons	6,300
Magnesite (approximately), short tons	18,000
Clays, kaolins (1899), short tons	8,230
Precious stones,	$170,000
Barite, short tons	1,824
Diatomaceous earth, short tons	411
Sulphur, borax, ozokerite, potash nitre—unimportant	

Since the war, production has decreased to at most a pitiful third or a fourth of the figures given in Table I, with the exception of that of oil, which has decreased by about one-half of its previous figure.

No attempt is here made to discuss in detail the enormous coal and oil resources of the old Russian Empire. An adequate discussion of either would run into many pages. Summaries are available in textbooks.

Russia is a small per-capita consumer of coal, due to the relatively slight development of her industries, and because of the use of wood or oil in many of her factories. The coal production rose from 330,584 short tons in 1860 to 35,500,674 in 1913. Approximately one-fifth to one-sixth came from Poland, which field presumably never again will be Russian. In 1913, Russia imported about 10,500,000 short tons, largely from England and Germany.

The coal fields of Russia are well situated, near the larger cities and manufacturing centers. The Donetz Basin is without forest, and is the most important iron district of Russia. It produced two-thirds of the coal of the old empire, of which latter approximately one-sixth was anthracite. The coal fields of Siberia are large, widely distributed, and contain coal ranging from anthracite to lignite. The product, amounting to about 2,000,000 tons annually, is practically all used locally, largely by the railroads. The most important field is the Kuznetsk Basin, near the Altai Mountain mines. On the west coast of Sakhalin Island are a number of coal deposits of Cretaceous and Tertiary age.

RUSSIA FORMERLY LEADER IN PETROLEUM PRODUCTION

From 1898 to 1902 Russia led the world in petroleum production, practically all oil coming from four pools in the Baku region covering less than ten square miles. The peak production was that of 1901, which was 85,200,000 bbl. In 1913, Russia produced 17.8 per cent of the world's total production. Prior to 1860, its output did not exceed 20,000 to 25,000 bbl. per year. The production for the ten years 1911 to 1920 is given in Table II.

TABLE II—RUSSIA'S PETROLEUM OUTPUT, 1911 TO 1920 INCLUSIVE

	In Barrels
1911	67,383,000
1912	68,227,000
1913	67,685,000
1914	67,106,000
1915	68,854,000
1916	72,553,000
1917	62,443,000
1918	40,456,000
1919	25,498,000
1920	30,000,000

The figures represent a slight decrease in pre-war times, and a disastrous decline since the Soviet *coup d'état*. To the end of 1920, Russia had produced approximately 24 per cent of the world's oil. The relative importance of the various pools is shown in Table III.

TABLE III—RELATIVE IMPORTANCE, AS REGARDS PRODUCTION, OF RUSSIAN OIL POOLS

	1910 Per Cent	1913, Per Cent	1917, Per Cent
Four old Baku fields	81.7	69.2	50.8
Binagad	2.0	5.8	7
Surakhan	1.8	7.1	18.5
Sviatoi (Holy Island)	0.2	0.9	1.3
Total Baku	85.7	83.0	77.6
Grozny	12.6	13.1	18.3
Cheleken Island	1.1	1.3	
Maikop	0.2	0.9	4
Emba-Ural	...	1.3	
Ferghana	0.3	0.3	

Pre-war consumption was from 63,000,000 to 75,000,000 bbl., the oil being largely used in Russia by the Russian industries, by the Volga River fleet, and by the state railroads. The peak of exports was reached in 1903, when 11,220,000 bbl. was exported; in 1913, 5,760,000 bbl. was exported.

Baku Field Has Long Life Ahead

For thousands of years, the Baku natural gas springs were venerated by fire worshipers, and oil was exploited in the vicinity of Baku by the Persians at least as early as the ninth century A.D. In the first half of the eighteenth century, petroleum was exported from Russia to England, and in 1813 about 12,000 bbl. of oil was exported from Baku. The real Baku oil industry dates from 1871, when drilling began, all previous production having come from hand-dug wells.

Near Baku, on the Aspheron Peninsula, are the four old pools of Balakhan, Saboontch, Roman, and Bibi-Eibat, and the newer pools, Bagdad, Surakhan, and Sviatoi (Holy Island), the last lying a mile off shore. The pools are located on rather steep domes, complicated by faulting. The oil sands, which are numerous, are notably lenticular, and occur in a soft Tertiary sand and clay series, which causes tremendous drilling difficulties. Some of the oil is recovered from pits sunk by hand, but the deeper wells reach 3,000 ft. Gushers of 10,000 bbl. are by no means unusual, and until the limestone reservoirs of Mexico were pierced, the Baku had no rival as a large-well field. The acre yield has been tremendous, the Bibi-Eibat pool (250 acres) having produced over 1,500,000 bbl. per acre. The Baku production will continue to be large for many years, and, properly controlled, development will doubtless locate other pools. In 1913, the Baku and other Caucasian fields employed about 60,000 workmen, largely Russians and Armenians.

Grozny Pool Important—Maikop Disappointing

North of the Caucasus Mountains is the Grozny pool, in the Government of Terek. The first gusher was found in 1903, although oil had been obtained from hand-dug pits sixty years before that. The pay sand is from 3,000 to 4,000 ft. deep, the pool being on an anticline of Miocene rocks. Its relative importance has increased in recent years. In 1914, there were 773 wells, of which 385 were producing, and in 1916 487 were producing. The pool since the Soviet regime began has been badly damaged by fires, but presumably will produce much oil in the future. Grozny is connected, as is Maikop, by pipe line with Novorossiysk, on the Black Sea. The Bellik field, discovered in 1912, is near by.

Maikop, in Kuban Government, which had produced from dug wells, caused much excitement in 1909 when a large gusher was struck. A number of highly capitalized English companies rushed in, but the production of the field has been distinctly disappointing. The oil occurs in Upper Oligocene rocks on an apparent monocline at a depth of about 500 ft. North of the Caucasus Mountains are several other smaller pools, and some production has also been obtained on the Tamān and Kerch peninsulas, at the mouth of the Azof Sea. On the south slope of the Caucasus Mountains small pools occur in the governments of Elisavetpol and Tiflis.

On the east shore of the Caspian Sea is Cheleken Island. Gushers were struck on a dome, but the production has rapidly declined, as the gushers ceased to flow just before the war. On the mainland, wells have been drilled at Napthnia Gora, in Transcaspian Government.

An extensive territory on the northeast shore of the Caspian Sea has a large number of oil seeps. This, the so-called Emba-Uralsk district, began shipments about 1910, and the increase in production has been rapid. The region is a complexly folded one, and as the oil-bearing rocks are largely covered by Pleistocene beds, the structure must be determined by drilling. The principal pool is that of Dos-Sor, which in 1914 had forty-six productive wells, including some gushers. The Novo-Bogatinsh pool is less completely developed. Further east, in the neighboring government of Turgai, light oil was struck at Diusa at relatively shallow depth. This region will presumably become an important oil producer.

Several small pools have been developed in Ferghana, 1,000 miles southeast of the last-named district, including Chimono, Sel-Rokh, Shar-Sou, and Mali-Sa. Dug wells are common, and the oil is refined locally.

Uchta Field Isolated but Promising

Nabatoff, a Moscow merchant, was, as early as 1745, treating about 1,000 bbl. of oil a year in a small refinery in the Uchta oil field, situated in north central Russia near the Arctic Ocean. The oil was obtained from shallow pits sunk in the outcrop of the oil-bearing rocks. The chief product was kerosene, which was sold in Moscow for lighting purposes. Others later put up small refineries in the district, but by the end of the eighteenth century the industry had disappeared. Peter the Great is reported to have sent samples of the Uchta oil-bearing rock to Holland for chemical analysis. About 1909, the Imperial Government drilled the district and brought in several small, shallow wells, yielding a light oil. The district is isolated and desolate, but is promising.

On the east coast of the Russian portion of Sakhalin Island, about twenty groups of asphalt seeps (one consists of approximately 200 seepages) have been discovered, the first being known in the 80's. The oil-bearing rocks are of Tertiary age, although post-Pliocene deposits mask them somewhat. Five or six companies have at various times put down about nine shallow drill holes, the deepest being about 930 ft. A

certain amount of heavy asphaltic oil was encountered in several of them, notwithstanding the fact that most of the locations were structurally poor. The oil appears to come from at least three different horizons.

Shallow wells have been drilled in the Government of Volhynia, in southwest Russia, near the Galician field. Oil seeps occur in the governments of Saratov, Simbirsk, and Samara in the basin of the Volga River, and near Lake Baikal, in Siberia.

Russia and the west half of Siberia are predominantly composed of sedimentary rocks, and considering their composition and structure it would be extraordinary if important oil fields do not exist which are unmarked by asphalt seeps. It is confidently believed that the old Russian Empire, if it eventually be prospected for petroleum, as is probable, will develop many oil pools the existence of which is not at present suspected. In résumé, the oil resources of the old Russian Empire are great, and are beyond the estimates of most geologists and engineers.

Northern Russia is supposed to contain large reserves of oil shale.

In the Baku region natural gas was burned in the fire-worshipers' temple prior to Christ's birth. Jonas Hanway, an English traveler, found that natural gas was used to light houses in Baku in 1750. Baku has been, however, probably the most criminal waster in the world of natural gas, although a small amount has been used around the rigs in drilling.

Peat exists in large quantities in Russia, and in pre-war times approximately 5,500,000 short tons was used annually, in part for domestic purposes, in part for factory fuel, and in part to develop producer gas. Early in the war, the amount was doubled, owing to the difficulty in obtaining the usual supplies of coal.

Production of Asphalt and Salt Important

Russia has been a considerable producer of asphalt and allied substances, as is indicated by the latest figures at hand, which are given in Table IV. Most of the asphalt comes from the Government of Simbirsk, where it occurs in veinlets in, and impregnates, Carboniferous limestones. There is also in this government, to the north of the Samarskaia-Souka, a large area of sand containing 20 per cent of semi-fluid bitumen. Bitumen and bituminous rocks have been quarried in this region since 1874, and three factories prepare the material for road building. A little asphalt is produced at several localities in the Caucasus Mountains and in Ferghana. Asphalt is also found in the Uralsk Government. On Sakhalin Island there are several fair-sized asphalt deposits, one of which is estimated to contain 400,000 tons.

TABLE IV—RUSSIA'S PRODUCTION OF ASPHALT AND ALLIED SUBSTANCES, 1906–1910

	Short Tons	Value
1906	12,517	(a) $110,294
1907	14,116	(a) 101,705
1908	24,961	(b) 491,302
1909	2,665	(b) 4,599
1910	27,544	(b) 176,518

(a) Includes mineral pitch; (b), includes ozokerite.

Wurtzilite occurs near Lake Balkash, in the Government of Semiryechensk, in southwestern Siberia. Ozokerite accompanies dried petroleum products in pockets in Tertiary sand on Cheleken Island (east of Baku) and in smaller quantities at Kaikop. Gilsonite, or a related hydrocarbon, was formerly worked in the Caspian governments on a small scale.

The United States is the largest producer of salt in the world, and in pre-war times Germany, Russia, and Great Britain contended for second place. In the Government of Perm, salt production dates back to the middle of the sixteenth century, and it at one time supplied the whole country. As early as 1830 the yearly production was 378,000 short tons. The production in 1909 was 2,255,000 short tons; in 1910, 2,279,000; and in 1911, 2,220,000. Russia in pre-war times exported a little salt, particularly to Persia, but imported for her own needs much more.

Russia's reserves of salt are large, and the industry is capable of great expansion. More than one-half of Russia's production comes from saline lakes, somewhat over one-quarter from rock-salt mines, and most of the remainder from brine wells. On the Lower Donetz, the chief mining region, rock salt occurs associated with gypsum and anhydrite in clays and marls of Permian age. The chief producer is the Government of Kharkov. Rocks of similar age containing salt are exploited in the Government of Perm, on the latitude of Petrograd. Salt is also mined in the Government of Vologda, approximately 500 miles west of the last-named locality. Large rock-salt deposits also exists in the Government of Orenburg, in Transcaucasia, in Yakutsk, and in Ferghana. In the Donetz region the salt is obtained from mines, and that of the Perm Government is obtained from wells sunk to the salt horizon.

To the south of the Trans-Siberian railroad are a number of salt lakes in the general vicinity of the Aral Sea, the principal producers being the Semipalatinsk and Akmolinsk governments, and also Astrakhan, in European Russia. The chief lakes are Baskunchak, in Astrakhan, and Koryakovsk, in Akmolinsk. Work is usually confined to the summer months, during which the water of the shallow lakes has been largely evaporated by the sun's heat. Methods of exploitation are, as a rule, primitive.

Salt is also produced from a number of springs, particularly in Siberia. In the Government of Tomsk are the Great and Little Marmyshansk lakes, also desert lakes, but from which glauber salt (mirabilite), rather than salt, is harvested. The annual production in pre-war times was about 6,300 tons. Glauber salt was produced from other Siberian lakes and springs, bringing the total production to almost 7,000 tons. Of this, part went to soda works, part was used in smelting Altai ores, and part in glass manufacture. The reserves are presumably large. A thick bed of glauberite was at least once worked on a small scale at a place about 25 miles from Tiflis (Caucasus).

Some Borax, Potash, and Niter Produced

Borax occurs as an efflorescence on the mud volcanos of the peninsulas of Kerch and Taman, south of the Sea of Azov. With it are associated salt and soda, and, in the past, a certain quantity of these minerals was recovered by evaporating the brine obtained by dissolving the mud in water.

The pre-war potash industry consisted of the extraction of potash from wood ashes and from the stems of sunflower plants. The total annual production amounted to about 20,000 tons of low-grade potash. Potash niter occurs in the Caucasus Mountains and in the Transcaspian governments, but it was in pre-war times exploited only on a small scale for local wants. Niter is also produced in east Russia from artificial niter plantations, but most of the saltpeter used in Russia is imported from Chile. It was stated in 1916 that large deposits of rather low-grade saltpeter had been found in the Eocene of Ferghana. in Russian Turkestan.

Thick beds of alum stone occur in the Government of Elisavetpol, south of the Caucasus Mountains. Alum

plants existed there in the 50's of the last century, but it is doubtful whether there has been production recently.

Russia possesses large reserves of rock phosphate, and from it and sulphuric acid, derived from the Ural pyrite, superphosphates could probably be manufactured to advantage. In pre-war times a small phosphate industry existed in Russia, but foreign plants produced the substance so cheaply as to compete successfully with the Russian manufacturers in their own field. A little lime phosphate was exported to Germany prior to the war from the Podolia region (southwestern Russia), the only field exploited. The reserves are estimated to be 1,500,000,000 tons running 50 per cent tricalcium phosphate, although the rock mined was of much higher grade. Mining is chiefly by underground methods. The phosphate occurs as nodules in Silurian shale of littoral origin and contains approximately 70 per cent of lime phosphate. In south-central Russia, between the Dnieper and Don rivers, phosphate occurs in rocks of Cretaceous age, which are predominantly sandy marls. The phosphate occurs as dark-colored nodules or lenticular beds containing from 30 to 60 per cent phosphate of lime. Phosphate beds were discovered in the Government of Vologda in 1896 in the district of Ustj-Syssolsk. They are said to contain from 27 to 38 per cent phosphoric acid. Phosphate rocks are also known at a number of other places in Russia. The production of rock phosphate in 1912 was 27,558 short tons; in 1913, 27,558; and in 1914, 15,432.

Sulphur, Gypsum, and Barite

Twenty years ago the Russian sulphur production amounted to several thousand tons a year, but immediately prior to the war it was small, and the sulphuric-acid plants of the country used pyrite from the Ural copper mines as raw product. The Permian rocks on the banks of the middle Volga contain sulphur in veinlets cutting gypsiferous marls. Some celestite accompanies the sulphur. Sulphur is also mined on a small scale in Transcaucasia, the mineral being interbedded in Tertiary marls. The deposit is of considerable future promise.

Gypsum occurs in the Ordovician rocks in north-central Siberia and in Devonian rocks in the Altai mountain region.

Barite occurs in vein form at a number of places in the Caucasus Mountains, the annual production being about 1,500 tons. As is usual with that mineral, the production is derived from a number of small exploitations.

Second to Canada Formerly in Asbestos Output

Prior to the war Russia was surpassed only by Canada as a producer of asbestos. The production before the war was as follows: 1912, 18,594 short tons; 1913, 19,284; and 1914, 17,296. Prior to 1912 the production all came from the Ural Mountains, but in the latter year exploitation of deposits in the southern Urals (Orenburg Government) and in the Krasnoiarsk district, in south-central Siberia, began, although their production was unimportant up to the outbreak of the war. Asbestos deposits also exist in the Irkutsk Government and in the Caucasus.

Practically all of the Ural production came from Baskenovo, in the Government of Perm. Most of the operating companies were Russian, although some Italian capital was interested. It was rumored some months ago that an American company obtained rights from the Soviet Government to certain of the deposits. Although some asbestos was worked up in Russia, most of it was exported (from 1911 to 1913 over 85 per cent of the production was exported), particularly to Germany, the chief port being Riga. Immediately prior to the war, a certain amount was exported to England, but at that time only a little crude reached the United States. Baskenovo (60 miles northwest of Ekaterinburg) lies in a belt which contains a number of masses of serpentine, the belt being approximately 18 miles long and from 2 to 3 miles wide. The asbestos-bearing portions of the serpentine are elliptical in form, the largest being 3,500 ft. long and 1,000 ft. wide. Asbestos occurs as cross-fiber in a stockwork of veinlets, the central portion of the ellipse as a rule being the richest in asbestos. The maximum width of the veinlets is 8 in.; a little slip-fiber is also present. The fiber is high grade, although less suitable for spinning than the Canadian. The deposits were found by a farmer in 1710, and Nikita Demidov, the founder of the famous mining family of that name, began mining soon thereafter. Various textiles were woven of the material for the next fifty or sixty years, but the demand was small and the industry languished. The open cuts were reopened on a small scale in 1883, and since 1889 the industry has prospered.

Mining is done in open pits largely by contract miners who spend most of their time farming. In consequence of this and a severe winter climate, mining is confined largely to the months of May, June, September, and October.

Prior to the war, Russia was producing no graphite, although several thousand tons was mined during the Russo-Japanese War in the Turuchany district on the Lower Yenisei River, near the Arctic Circle. This promising prospect, producing high-grade graphite, was discovered in 1860 by Sidorow, a trader. The famous Alibert (Siberian) mine, near Lake Baikal, was abandoned in 1858. Here high-grade graphite, particularly suitable for pencil manufacture, occurred as irregular nodules in an intrusive body of nepheline syenite. Large lenses of graphite occur in the Dzimarsk district, Caucasus; and graphite also has been found in northern Siberia, on the Pacific Coast, and in the Urals.

Fluorspar, Monazite, Magnesite, and Talc Occur

Fluorspar occurs in eastern Siberia, and a small quantity of the mineral has from time to time been mined there. Fluorspar suitable for optical purposes is found in the Adun Chilon Mountains, Transbaikal.

About twenty-five years ago the Russian placers of both the Ural Mountains and of Siberia produced considerable monazite. Thorianite associated with monazite occurs as a constituent of the gold placers of certain of the Transbaikal (Siberian) streams.

Mica is not produced in any quantity, although the pegmatite dikes of the country undoubtedly contain commercial quantities of not only mica but of feldspar and quartz. In the past a small amount of mica has been produced from time to time, and it will be remembered that mica was, two hundred years ago or so, called "Muscovy glass" and was used in Russia for window panes.

Magnesite has been mined in the past in Ufa Government, southern Urals, at about 55 deg. N. It also occurs about 200 miles farther south in the Urals and also on the north slope of the Caucasus Mountains. A considerable quantity of magnesite was formerly produced at the first-named locality, the production in 1906 being 29,013 short tons, the pre-war production probably

being between 16,000 and 20,000 tons. The magnesite was made locally into bricks. Talc occurs in several places in the Caucasus.

Corundum occurs at Karnilowsk, in the Altai region, and also on the Kyshtym Estate, in the Urals, but at neither locality is it mined. At the latter property it occurs in kyschtymite, a corundum-anorthite anorthosite.

Cryolite occurs in small quantities at Miask, in the Urals.

A pumice deposit had been worked and exhausted before the war, at Malaya Kutma, near Kars, Transcaucasia. The grade was reported to be excellent. Several other deposits are reported to be partly developed in the same district.

Diatomaceous earth is reported from Transcaucasia, and two small quarries were operating in pre-war times, producing about 600 tons a year.

Bauxite is reported to exist about 200 miles southeast of Petrograd.

The manufacture of portland cement in pre-war times was a growing industry, there being about thirty-three plants in 1912, and just prior to the war an equal number of plants were being erected. Some of the companies paid handsomely, and the expected capacity of the plants in operation and in process of construction at the beginning of the war would have satisfied only approximately one-sixth of the Russian demand. The production, according to *Concrete* (1917, p. 113), in 1912 was 1,805,000 short tons; in 1913, 2,333,000 short tons; in 1914, 3,611,000 short tons (estimated); and in 1915, 5,057,000 short tons (estimated). In 1911 about 450,000 bbl. was imported, largely from Germany and Sweden.

A considerable amount of ceramic clays are produced in the southwest corner of European Russia, particularly in Ekaterinoslav Government. These were used in local potteries. The last statistics I have at hand for the production of porcelain clays are those of 1899, when 8,230 short tons as produced, of a value of $34,050. In the Tula coal field to the south of Moscow there are interbedded deposits of fireclay, excellent for the manufacture of refractory wares.

Lithographic stone occurs in Perm and Podolia, and slate occurs in several different districts. Russia also has its full share of decorative and ordinary building stones.

PRECIOUS AND SEMI-PRECIOUS STONES PRODUCED IN PAST

The value of the precious stones produced in Russia annually in the past amounted to about $170,000. Semi-precious stones are produced in considerable quantities in two parts of the old Russian Empire—the Central Urals and the Altai Mountains. The Ural semi-precious stone trade dates from 1755, when there was established at Ekaterinburg a precious-stone cutting industry. It uses, in addition to precious stones, a large number of decorative stones from the Urals, such as melachite, rhodonite, and jasper. A smaller cutting industry exists at Kolyvan, in the Altais.

About 220 diamonds have been found in sixteen localities in the Ural Mountains. In addition, four diamonds have been found in three different localities in the Yenisei River district, and, further, a number of small stones have been found in the extreme northwest part of Russia, near the Arctic Ocean and the Swedish frontier. It is remotely possible that commercial deposits may eventually be discovered in the Urals.

In the Urals, the semi-precious stones are largely recovered from streams, often in gold washing. The Urals semi-precious stones include cymophane, amethyst, tourmaline, topaz, emerald, beryl, phenacite, euclase, rock crystal, garnets of several species, and cyanite. The original source of most of these stones is the pegmatite of the region, and emerald, topaz, phenacite, and amazonstone are largely obtained from the pegmatite dikes themselves. In addition, the copper mines of the Urals are the most important source of ornamental malachite, and rare green garnets—demantoid and uvarovite—are obtained from veins in serpentine. It will be remembered that the variety of cymophane called alexandrite is dark green by daylight and raspberry red by artificial light. It is one of the most remarkable of coincidences that this stone, which in its dichroic colors flashes the military colors of the old regime, was first found in 1833 on the day on which the majority of the Czarevitch, afterward Alexander II, was to be celebrated. The mineral was named after the young prince.

Aquamarine, topaz, colored tourmaline, ruby, sphene, smoky quartz, and amethyst are obtained from various deposits in the Altai Mountains, largely from the vicinity of Mursinka.

Amber occurs in Eocene rocks from the Baltic to the Black Sea, and before the war in Courland there was a small production. Jade and lapis lazuli are found near Lake Baikal, in Siberia, and turquoise in Russian Turkestan. Meerschaum is said to exist in the Crimea.

Mineral waters in Czarist days were produced in considerable quantities, particularly from springs in the Caucasus Mountains.

The Latter Day Search for Chicova

In recent times several well-known South Africans have searched for the once famous silver mines supposed to be in the Chicova area of the Zambesi Valley, according to a writer in the *South African Mining and Engineering Journal*. The systematic exploration of this area has now been undertaken by a recently formed Belgian company known as the Miniere Zambezienne. M. de Malycheef has prospected the region for the company in an effort to relocate these long-lost mines, the quest of which is said to have caused much bloodshed, adventure, and speculation.

Prominent among those who have made the search in recent years has been Colonel Sir Aubrey Woolls-Sampson, who first heard of rich silver deposits from an old native whom he met near Dhlo-Dhlo, in Matabeleland. The native told of a certain curiously shaped mountain, but said that they would be unable to penetrate into the mineralized belt because of the growth of thick masses of spear-shaped aloes surrounding the mining district. He found the mountain, but could not proceed further, on account of the aloes. Years later, Sir Aubrey started off from Lusakas, in northern Rhodesia, and trekked southwestward toward the Zambesi. He got into some country which appeared to be uninhabitable. When he reached the Luangwa River his natives refused to go farther, saying that the Luango was the country of the dead, and that it was inhabited by ghosts. There was no alternative but to return. Later he reported his adventures to the Administration of Northern Rhodesia, which sent an expedition there. Another tale is told of a prospector, who, dying, told of a discovery he had made of a large deposit of argentiferous galena near the road between Fort Jameson and Tete.

CONSULTATION

The World's Production and Uses of Quicksilver

"In *Metal Statistics* for 1922 I note reference to mercury, but no statistics seem to be embodied as to world production. I will greatly appreciate your outlining for me the production of cinnabar and mercury of the various countries for the years 1911, 1912, and 1913, and the 1921 and 1922 output. I would also like to know the per cent recovery of cinnabar from the various properties producing mercurial ores.

"I note the minimum price average was in 1913, $39.54 per flask. Does it seem logical to expect this price to obtain again, or will the price remain generally at a minimum above $50? What is the possibility of this metal, and what countries in order are the greatest consumers? Also, can you give me an outline of the general uses for mercury?

"Can you give me the address of the *Mining and Engineering World* or tell me where I might obtain back numbers of that paper?"

Statistics of the world's quicksilver production can be found in the *Mineral Resources* of the U. S. Geological Survey. The figures covering the years 1911 to 1920 inclusive by countries are given as follows:

WORLD PRODUCTION OF QUICKSILVER, IN FLASKS

(One Metric Ton = 29.395 Flasks)

Country	1911	1912	1913	1914	1915	1916
United States	21,256	25,064	20,213	16,548	21,033	29,932
Austria	(a) 20,694	(a) 22,428	(a) 24,104	(b) 25,000	(b) 25,000	(b) 25,000
Hungary	(c) 2,339	(c) 2,494	(c) 2,606	(b) 2,500	(b) 2,500	(b) 2,500
Italy	(d) 28,072	(d) 29,406	(d) 29,513	(d) 31,541	(d) 28,954	(e) 32,129
Russia	.....	.....	.....	.....	(h) 800	(h) 1,100
Spain	(i) 43,912	(i) 36,921	(i) 36,619	(i) 28,000	(i) 35,925	(i) 23,369
Mexico and other countries	(b) 4,500	(b) 4,500	(b) 4,000	(b) 4,000	(b) 4,000	(b) 4,000
	120,773	120,813	117,055	107,589	118,212	118,030

(a) Statistik des Bergbaues in Osterreich, Wien.
(b) Statistics not available. Estimate only.
(c) Ungar, statist. Jahrb., Budapest.
(d) Riv. servizio min., Roma.
(e) *Min. Jour.*, London.
(h) Metallgesellschaft, Frankfurt-am-Main.
(i) Statistics not available. Estimate based on oral information from Russian Special Commission to United States in 1917.
(j) Estadística minera de España, Madrid.

Country	1917 Flasks	1918 Flasks	1919 Flasks	1920 Flasks
United States	36,159	32,883	21,415	13,392
Spain (a)	25,147	16,677	36,055	25,330
Italy (b)	31,494	30,512	24,839	41,182
Austria	(c) 19,066	(c) 12,346	(d)	(d)
Hungary	(e) 2,781	(f) 2,352	(g)	(g)
Czechoslovakia	.....	.....	2,352	2,352
Mexico (h)	974	4,809	3,496	2,269
Other countries (i)	1,000	1,000	1,000	1,500
	116,621	100,579	89,157	86,025

(a) Estadistica minera de España, Madrid.
(b) Riv. servizio min. Roma. For 1920, advance figures furnished by the Italian Ministry of Agriculture through the U. S. Department of State.
(c) Castelli, Gaetano, La mina de mercurio de Idria: Rev. minera, metalurgica y de ingeniería, Madrid, Aug. 24, 1921.
(d) Output of Idria mine credited to Italy.
(e) Montanistische Rundschau, Wien.
(f) Statistics not available; estimate only.
(g) Deposits now in Czechoslovakia.
(h) Bol. minero, Dept. de Minas, Mexico.
(i) Estimated as flasks and quantity in metric tons calculated therefrom.

In 1921, the last year for which complete records are available, the tenor of the quicksilver from the ores in mines of California amounted to 0.52, and for the properties of Texas 0.65 per cent. The only mine worked in California during 1921 was the Senator mine of the New Almaden Co. The Chisos mine, in the Terlingua district, Brewster County, Tex., produced the only quicksilver recorded from that state in 1921. A few smaller mines in Oregon, Nevada, and Idaho contributed slightly to the total output.

The quicksilver deposits of Spain are among the most important in the world. The most productive Spanish quicksilver mine, the Almaden, mines an average of 8 to 9 per cent ore. In Italy the Monte Amiata (Tuscany) mines are the principal producers. The average tenor of the quicksilver ore is 0.9 per cent, but a rich shoot running close to 30 per cent is reported to be mined, furnishing perhaps 25 per cent of the total output. The ore is sorted, bringing the minimum content of the sorted product to 12 per cent, and the rich ore sent to the furnaces runs 18 to 20 per cent. Quicksilver is generally recovered by furnace methods utilizing the principle of distillation. A recovery of over 90 per cent can be obtained with careful supervision, but the average recovery probably ranges between 75 and 90 per cent.

So many factors enter into the possibility for higher or lower prices for quicksilver in the future that it is inadvisible to make any guess as to price trends.

The United States and Germany are the greatest consuming countries.

Quicksilver has a wide variety of uses, the most important being the manufacture of drugs and chemicals, followed by the manufacture of fulminates for detonating caps. Calomel, corrosive sublimate, mercuric oxides, and mercurial salts are chemicals in which mercury is a constituent. The metal is also used in the manufacture of such chemicals as glacial acetic acid, phthalic acid, and phthalic anhydride, in which the mercury itself does not enter, according to Ransome. Although quicksilver makes an excellent fulminate, substances were discovered during the war which would replace that detonating chemical. One of them, lead azide, is so sensitive that large dry crystals of it will explode when brushed with a feather, but smaller crystals are less sensitive. The use of substitutes will naturally cut into the demand for quicksilver in detonating compounds.

Mercuric sulphide, a brilliant red, is used as a pigment. Mercury vapor lamps and other electrical apparatus consume quicksilver, and mercuric nitrate is used in the manufacture of felt hats. The amalgamation of gold and silver ores is another consuming channel. Thermostats, barometers, and other appliances may contain the metal. Anti-fouling paints for use in marine work are said to take increasing quantities of the metal. Boiler scale preventive compounds, cosmetics, and dental amalgams may have use for quicksilver. Other minor uses exist, but the most important have been outlined above.

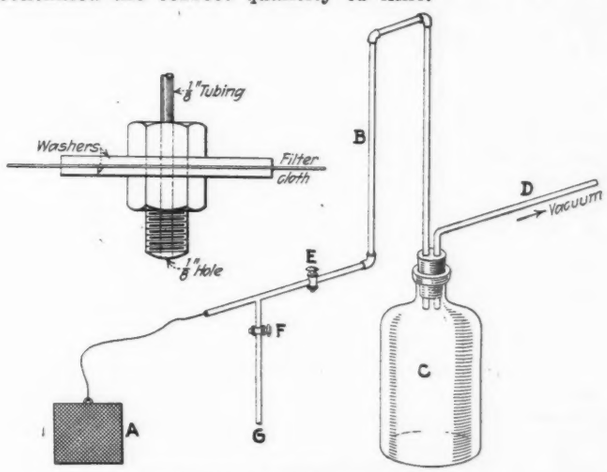
The *Mining and Engineering World* is no longer published, having been combined with *Engineering and Mining Journal* many years ago. Back numbers can be consulted at public libraries or engineering societies libraries.

USEFUL OPERATING IDEAS

A Continuous Alkalinity Indicator for Flotation Pulp

BY B. H. MCLEOD

In some recent experiments on floating a certain ore, it was found that the highest recovery was obtained when using lime to the extent of 0.5 lb. per ton of ore in excess of that required to neutralize the acidity. The acidity of the ore pulp required from 5 to 20 lb. of lime per ton for neutralization, and because of this variation it was difficult to feed the lime, in practice, so that there should be an excess of 0.5 lb. per ton of ore. To overcome this, an indicator was designed which would show when the flotation pulp contained the correct quantity of lime.



Continuous alkalinity indicator

The accompanying diagram shows the essential points of the indicator. *A* is the filter; *B* the indicator tube containing fused phenolphthalein; *C* the container; *D* vacuum line; *E* and *F* are valves; and *G* is the air or water line.

The filter *A* is placed at the head of the flotation machine and connected to *B* through the valve *E* by a ⅛-in. copper tube. *B* is connected to *C*, and *D* in turn to a vacuum line. When the vacuum line is opened the water in the pulp is filtered through the bag and the indicator tube into the container. If the water is red the pulp is alkaline, and the intensity of the color depends to a certain extent on the alkalinity. By comparing the color and the results obtained by titration, the operator can soon learn the color corresponding to the 0.5 lb. of excess lime. Every few hours the valve *E* is closed and *F* opened, thus supplying low-pressure air or water to the bag for cleaning off the slime cake.

The filter bag consists of a piece of 6-mesh screen 6 x 6 in., over which is sewed one thickness of filter cloth. It will last for several months.

A tube of small diameter is used so as to bring the filtrate to the indicator tube as soon as possible. This ⅛-in. tube is attached to the filter bag as shown in the diagram. A ½-in. capscrew is drilled through, and the copper tube is soldered in the hole. The capscrew is put in a hole in the filter cloth and the filter cloth clamped between two washers, which of course must be done before the bottom of the bag is sewed up.

The indicator tube is prepared by taking a ¼-in. glass tube 24 in. long, in one end of which is placed about 0.5 gr. of phenolphthalein. The tube is now heated to near the melting point of the salt (253 deg. C.), and then the salt is heated just to melting and allowed to run down and coat the inside of the hot tube. If these precautions are followed the tube will be coated with a thin film of the salt, which, when fused, has a straw-yellow color. Care must be taken not to heat the salt much above the melting point, as it decomposes to a black and tarry mass which is not effective.

Other methods, such as an alcoholic solution supplied by a wick, and percolating the filtrate through lumps of the fused salt, were tried, but the indicator tube was found the most successful, as it always presents a standard surface to the filtrate.

A tube will last several days, but is better if renewed every day. One ounce of the salt should be sufficient for two months.

The apparatus is simple to construct and the cost of operation is negligible. It gives a continuous indication of the alkalinity of the pulp, which could otherwise be obtained only by taking samples, filtering them, and titrating.

A Self-Dumping Bucket

BY A. W. ALLEN

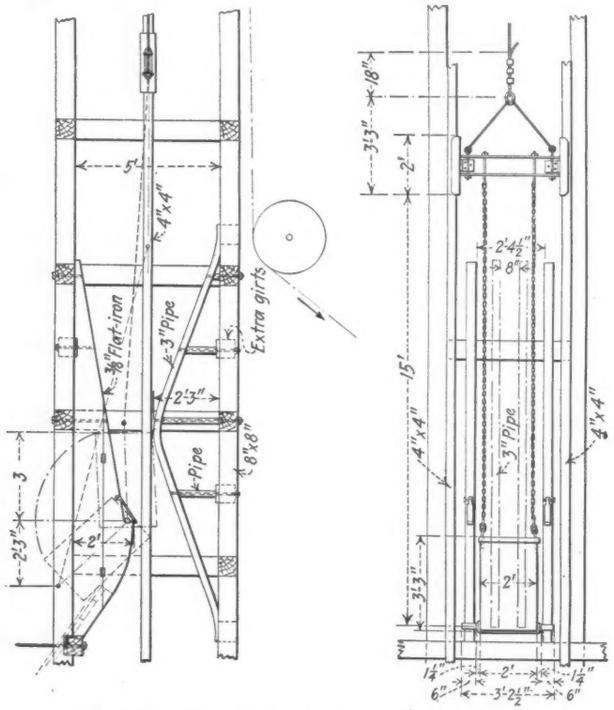
When visiting recently the new shaft of the Black Hawk mine, at Randsburg, Calif., I was interested in a type of self-dumping bucket that appears to embody all the obviously satisfactory features of the original idea, plus some structural and detailed modifications that should commend it as suitable for wider adoption. The general arrangement was originally used underground in connection with shaft-sinking operations on the property of the Pittsburg & Mount Shasta Gold Mining & Milling Co. near Redding, Shasta County, Calif., having been developed by E. Jansen, of the staff of C. F. Wieland, consulting engineer, of San Francisco, and D. A. McCormick, superintendent.

The drawing herewith shows a side and front elevation of the equipment above the collar of the shaft; it pictures an ordinary type of sinking bucket, welded throughout, fitted with two projecting lugs near the bottom and supported by two chains from the crosshead. The bucket, on being hoisted, rides against two deflecting rails, made of 3-in. steel piping. In doing so, the lugs are guided toward a hinge, which is lifted, thus permitting them, when the bucket is lowered, to rest in a cradle, as shown. The ore is then dumped on to a fixed apron, by which there is no possibility of discharging rock down the shaft.

On rehoisting the bucket, the lugs pass above the

hinge. When lowered again this is turned down, so that it forms a guide over and above the cradle; whereupon the bucket is deflected back toward the pipe guide and thence to its central position between the timbers.

As previously mentioned, there is nothing new in the idea of dumping such a bucket by mechanical means. The feature of the installation described is that sundry



Detail of bucket-dumping arrangement

well-known principles have been utilized and the design of the apparatus has been modified so that a "fool-proof," workable, and labor-saving unit for use in connection with a vertical shaft has been evolved. For the opportunity of seeing this bucket in operation before shaft-sinking at the Black Hawk mine was started, I am indebted to J. O. Greenan, superintendent, and D. A. McCormick, engineer.

Analysis of Monazite

The hitherto published methods for the attack of monazite are either tedious or else leave large quantities of the rare earths undissolved. (*Ann. Chim. Analyt.*, abstracted in *Journal* Soc. Chem. Ind.) By the following method the whole of the mineral can readily be brought into solution: About 1 g. of the finely ground material is heated for five hours with 5 c.c. of sulphuric acid (sp. gr. 1.84) at 230 deg. C. The resulting pasty mass is gradually poured into iced water, when all but a small residue passes into solution. This is filtered off and again heated with sulphuric acid, a little hydrofluoric acid being added to volatilize the silica. The residue is then melted with six parts of sodium carbonate. On treatment with water the tantalum passes into solution, and any slight residue still remaining will be zirconia and may be brought into solution by fusion with potassium bisulphate.

In the subsequent analysis the rare earths should be precipitated by oxalic acid at 55 deg. C. in a solution containing 0.15 to 0.75 per cent of sulphuric acid and with an excess of 3 per cent of oxalic acid. At this temperature precipitation may be considered quantitative for yttrium, thorium, cerium, and didymium. Lanthanum oxalate, being the most soluble, is not completely precipitated, and 50 c.c. of the solution under the above conditions would retain 0.011 g. in solution.

Reversing Without Twisting the Belt

BY W. F. SCHAPHORST

Every once in a while I come across belt drives similar to that in Fig. 1 in which pulley *B* is the driving pulley and *A* the driven pulley. The reason for this unusual arrangement is that pulley *A* must rotate in a direction opposite to *B*, which would not be obtainable, of course, if a regular open drive were employed.

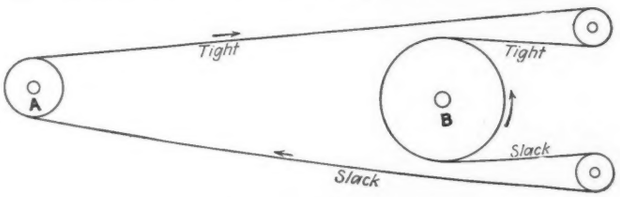


Fig. 1—Objectionable arrangement for reversed drive with uncrossed belt

To reverse the direction of one driven pulley the most common method is simply to cross the belt, and it is the method to be recommended where belts are narrow or where there is sufficient distance between shaft centers so that there will not be too much internal friction in the belt due to abrupt bending or too much rubbing of the belt against itself at the crossing point.

The arrangement shown in Fig. 1 is objectionable, however, because of the fact that one of the idler pulleys must resist the pull of two tight belts as indicated. Thus the upper idler pulley in Fig. 1 is subjected to a greater bearing thrust than is the main driving pulley *B*, the latter having a tight belt approaching and a slack belt leaving, which is as it should be for a driving pulley. Whenever idler pulleys are employed, both approaching and leaving belts should be slack. Idlers should be operated with as little friction as possible.

Fig. 2 is an arrangement that should always be preferred to Fig. 1, for the reasons mentioned. The drive is reversed, the belt is not crossed, and the idler pulleys

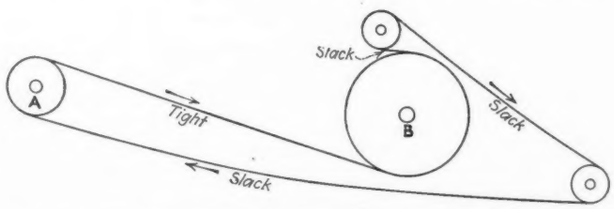


Fig. 2—Preferred arrangement for reversed drive with uncrossed belt

are not subject to great bearing thrust, because in both instances the approaching and leaving belts are slack.

Should there be insufficient space for an installation similar to Fig. 2, it would be better to install a third idler pulley, if necessary, so that the slack side can hug the driver all the way around, rather than to resort to the tight idler method shown in Fig. 1.

THE PETROLEUM INDUSTRY

Oil in Arkansas

Production Began in April, 1920, Near Eldorado, Union County—Four Counties Now Producing—Camden-Smackover Field Being Opened—New Well Brought In, Near Prescott, in September

By Tom Shiras

WITH FOUR COUNTIES producing oil, Arkansas' importance as a petroleum-producing state has been greatly increased. The most important development during the last few months has been in Ouachita County, where an unusually productive field is being opened. The first well in this field was brought in by the V. K. F. Drilling Co., in 29-15-15, on July 31, with an initial flow estimated at 500 bbl. Thirty-seven wells were completed between that date and Nov. 4. Of these only four have been dry or abandoned on account of water. Five of the remaining thirty-three have been gassers and twenty-eight have been oil producers. McDonald No. 1, the largest well in the field, was brought in on Oct. 30, with an initial flow estimated at from 15,000 to 20,000 bbl.

Twenty new wells were brought in, in the Eldorado Field, in Union County, during the week ended Nov. 4. This field was the first opened in the state. The new field in Ouachita County has been named the South Ouachita, or Camden-Smackover field. Camden is the county seat. Smackover is a typical oil town on the Missouri Pacific R.R., which leaped into being almost overnight after the discovery well was brought in. That part of Columbia County which lies in the Stephens district is making a light production. Late in September, a light producer was also brought in, in Nevada County near Prescott.

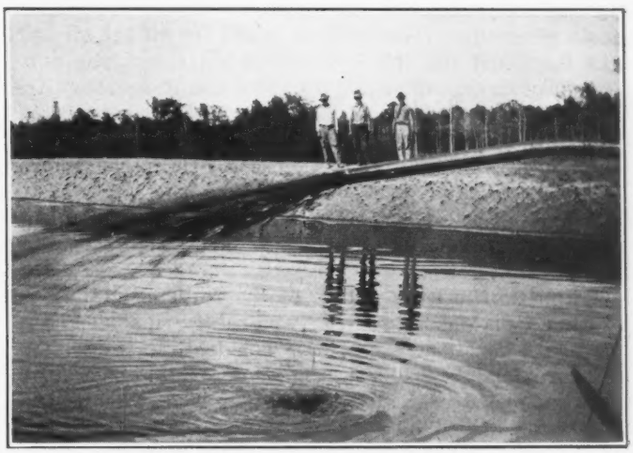
The producing areas are all situated in the Coastal Plain region, which lies northwest of the meanderings of the Mississippi River, reaching to the foot of the Ouachita Mountains and the Ozark Plateau. Dr. N. F. Drake, geologist for the State Bureau of Mines, in discussing the geology of this section says:

"The outcropping rocks are Tertiary and Quaternary in age. The Quaternary beds form a thin covering of alluvial materials lying on the Tertiary beds, along the flood plains of the river bottoms. The Tertiary beds consist of clays and marls more or less carbonaceous, sandstone, and some lignite beds. The strata dip gently toward the southeast. Going eastward over the area one passes over beds that are higher and younger geologically, and the series becomes thicker, until in the southeast part of the state these beds are probably 2,000 ft. or more in thickness. Under these beds the Cretaceous beds extend apparently without any breaks.

"During Tertiary times the Gulf of Mexico extended over this area in an embayment that reached northward to the southern point of Illinois, and is extended to the east of the Mississippi River into Tennessee and Mississippi, about as far as it extends westward from the Mississippi River into Arkansas. The underlying and older Cretaceous embayment was somewhat broader, but did not extend so far northward. The embayments gave good conditions for the accumulation of organic matter of the sea and neighboring land areas. Over this area also, with the possible exception of Crowley's Ridge, the rocks have not been altered to a degree that would injure oil accumulations, and the conditions are favorable for oil and gas wherever structural conditions exist to catch and hold it."

Geologists who have studied the south Arkansas field point out two possible sources of production: the Marlbrook marl, which underlies the Nacatoch sand, from which most of the production has been made to date, or the Brownstone marl, the Eagle Ford shale, or the Lower Cretaceous beds, which lie deeper. The accumulation of enough oil in the Nacatoch above the Marlbrook to form a commercial field is said to be due probably to an association of a source of oil, channels through which it can migrate, and a good reservoir bed. Oil has not formed everywhere in the Marlbrook, but in the most favored spots where it was laid down in shallow water, and possibly raised above the sea from time to time, the conditions being right for the deposition and preservation of the oil-forming matter. In any event, in some places the Marlbrook appears to have supplied large amounts of oil to the overlying Nacatoch sand, and in others, where the structure is seemingly as favorable, it has supplied little or none.

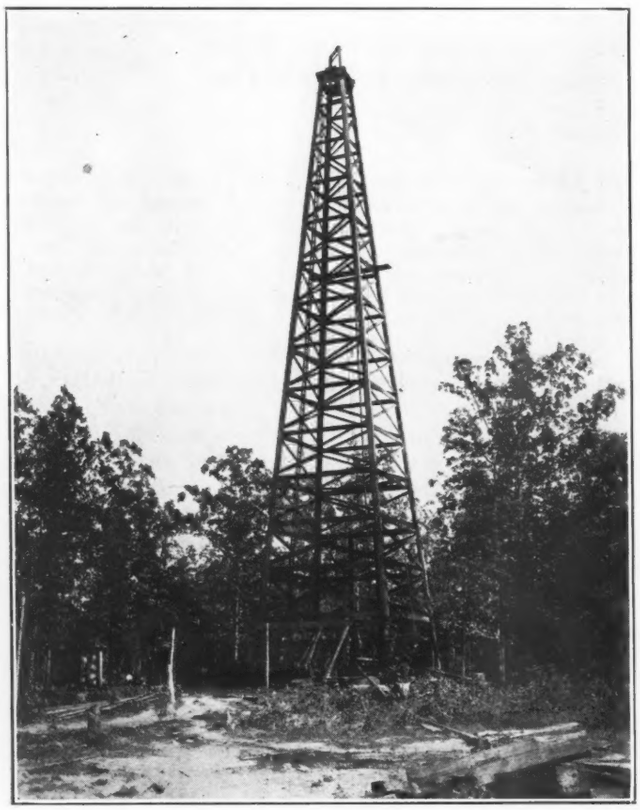
There is a chance, however, that the oil is not derived from the Marlbrook, but may come from a deeper formation. It could have originated in the Brownstone marl, the Eagle Ford shale, or the Lower Cretaceous



Earth tank storage. Richardson No. 1 well flowing approximately 30,000 bbl. daily

beds. Although they are much deeper than the Nacatoch, this would be no obstacle to the migration of the oil, for the faults which cut the Marlbrook would also cut them, thus furnishing channels up to the Nacatoch. The latter theory has been strengthened recently by the bringing in of three producing wells at around 2,900 ft.

The Eldorado field, near Eldorado, in Union County, was the first oil field opened in the state. The Constatin Oil & Refining Co. was the pioneer company, and brought in the first well, which was a big gasser, in April, 1920. The Busey well, now known as the discovery



Richardson No. 1 discovery well

well, blew in on Jan. 10, 1921, under a heavy gas pressure, with an oil production estimated at anywhere from 5,000 to 30,000 bbl. It was never controlled. A part of the production was caught in hastily thrown up earth reservoirs. Water came in and cut off the oil and gas flow, and the life of its productiveness was only forty-five days. Immediately after the Busey blew in, development started and has continued unabated ever since. In 1921, the field produced approximately 10,000,000 bbl. of oil. The production this year to Oct. 1 has been approximately 8,643,000 bbl. The field at this time has between 500 and 600 producing wells, 4,000,000 bbl. of storage, three pipe lines, numerous loading racks, and twelve refineries.

Owing to the loose nature of the formation, the use of cable tools was not feasible, and rotary rigs have been used with hardly an exception. The depth of production is approximately 2,200 ft., and most of the wells have been completed in thirty days. The cost of some of the first wells drilled by contract ran as high as $25,000. This figure, however, has been greatly reduced, a fair average now being $12,000.

Late last year the proven acreage of the field amounted to 6,825 acres. About 2,000 acres of this yielded gas and the rest oil. It is hard to get accurate figures on what the increase has been this year, but it has been considerable—probably as much again. The average spacing of the wells has been about fifteen acres. The oil produced in the field averages 35.5 deg. Bé. gravity, and comes within the range of paraffin-base oils.

The South Ouachita or Camden-Smackover field was approximately a half mile wide and two miles long when I visited it in September, but new production has enlarged this considerably since that time. The formations are much the same as those encountered in the Eldorado field. Rotary rigs are used exclusively, and the drilling costs are approximately the same. Smackover is in the center of the producing area. Camden is about twelve miles north. With new wells being completed every day, and market facilities getting better, the field will in all probability have a production of 100,000 bbl. a day by Dec. 1.

The Simms Oil Co. is erecting two immense tanks of 55,000-bbl. capacity on a tank-farm site at this time. As soon as production justifies, the company will probably lay a pipe line to Sibley, La. The Standard Oil Co., the Gulf, and the Atlantic Oil & Refining Co. are all erecting big storage tanks on tank-farm sites. The right of way for the 12-in. extension line of the Standard Oil Co. of Louisiana has been cut from Eldorado, and the work of laying the line will be started at once. The Bradstreet Oil Co. is laying a 4-in. line from its well to Smackover and is building a loading rack at that point. The Arkansas Natural Gas Co. is also laying a 4-in. line.

Among oil interests the development of the South Ouachita County field is looked upon as one of the most important of the year. Although the oil is of low specific gravity, testing from 20 to 22 deg. Bé., the large initial production and the way the wells are holding up make it desirable territory.

The Stephens district is near Stephens, in the southwest part of Ouachita County and the northeast part of Columbia County. This district first brought Arkansas into prominence as a possible oil-producing state. The Hunter well, which was drilled in June, 1920, proved the presence of oil, but was never brought in as a producer. It is common gossip in Ouachita County that one of the large companies bought up the field and is letting it lie for future use. Interest in the field died then, but was revived last year, when Luke Watkins drilled the Poverty well, bringing it in as a small producer. In September this district had six producers, all pumpers, which were making approximately 100 bbl. a day each. The production covered an area at that time of approximately one-half mile wide and six miles long, the oil testing 27 deg. Bé. gravity.

With the exception of the one well which was brought in in Nevada County, in September, no more tests have been completed, and the field is yet in a state of preliminary development.

No Doubt as to Value of Teapot Dome

The bringing in of a new oil well in Wyoming in the heart of the Teapot Dome area, which proves the second Wall Creek sand, is regarded by petroleum specialists in Washington as setting at rest any doubt as to the value of that reservation. As a result, the Sinclair Oil Co. will hurry its pipe line to the earliest possible completion.

New Books

Californian Nitrate Disappointing

Nitrate Deposits in the Amargosa Region, Southeastern California. By L. F. Noble, G. R. Mansfield, and others. Bulletin 724, U. S. Geological Survey, Washington, D. C. Free.

As Mr. Hoyt S. Gale (under whose direction the work was done) points out in the preface, the subject of the nitrate supply in the United States was brought into prominence during the World War because of the acute realization of the dependence of the United States on Chilean nitrates. On this account, the U. S. Geological Survey, among its other useful occupations, began especially to investigate the reports of nitrate supplies in the United States. At that time the most favorable source of supply appeared to be in the deserts of California and Nevada, hence the investigations described in the present bulletin. In this desert area, chief attention had been called by various investigators to the nitrate deposits along the Amargosa River near the boundary between Inyo and San Bernardino counties, in southeastern California, a region lying just south and east of Death Valley. "The conclusions reached in this bulletin are entirely unfavorable; they indicate that the deposits are not commercially workable," and the conclusion is extended to "nearly every reported deposit of nitrate in southeastern California."

The nitrate deposits of the Amargosa region are associated with stratified lake beds and sub-aërial deposits of Tertiary age. These beds have been deformed by folding, faulting, and igneous intrusion. Originally they consisted in part of stratified volcanic ash, and were accumulated during a period of active Tertiary volcanism. Intercalated beds of rock-salt and gypsum occur. These usually uptilted beds have been eroded into bare gray hills. The nitrate deposits overlie these Tertiary beds without regard for the stratification of the latter. They occur in a hardened or cemented layer of detritus (caliche), which forms a mantle or blanket following the configuration of the surface and usually less than six inches thick. The most common saline material in the caliche is ordinary salt, or sodium chloride; the sodium nitrate is quite subordinate. Over the caliche lies soft, porous soil, usually less than one foot thick. The bedrock underlying the caliche gives ordinarily faint reactions for nitrates, or none at all; therefore the nitrate deposits are confined to this caliche blanket. The report made as a result of careful investigation concludes: "It is extremely doubtful if the nitrate could be extracted from even the best of these California deposits at a cost sufficiently low to enable them to be worked at a profit in competition with nitrate from abroad or from other sources that can compete in the present markets." It is pointed out that "the areas containing the higher-grade portions of nitrate-bearing caliche are small, only a few acres at best, and these portions of the deposit are very irregular, pockety, and patchy . . . The average nitrate value of the best material in the richer areas is low, few of the carefully taken samples obtained in the present investigation carrying more than 5.25 per cent of sodium nitrate. The total quantity of nitrate in the best of the areas studied is too small to justify the outlay of capital necessary for its commercial recovery." The average sodium nitrate content of the caliche is less than 2.57 per cent (p. 92). It is estimated that the most promising fields contain only 1,980 short tons of refined nitrate.

This bulletin is an excellent example of an accurate, scientific, and highly commercially valuable piece of work in applied geology. Not only miners but students of political and commercial geology, statesmen, Congressmen, mining congresses, War Department and mining society committees, and others, may safely exclude the southeastern Californian nitrates from serious consideration. Further prospecting is not discouraged, but the known fields and the known probabilities are clearly disposed of. It is a piece of commercial and national service which only the U. S. Geological Survey could have done, and the type of work which makes this organization invaluable in its capacity for weighing and dispassionately pointing out facts. J. E. SPURR.

Manganese of Western Virginia

Manganese Deposits of Western Virginia. Bulletin No. XXII, Virginia Geological Survey, by G. W. Stose and H. D. Miser; University of Virginia, Charlottesville, Va. Obtainable on request.

The manganese ore deposits in western Virginia are widely distributed, occurring in many counties; they have been worked at times since 1834, yielding both manganese and manganiferous iron ores. The only notable production was during the Great War; in 1917 and 1918 each, about 5,000 tons of manganese ore running 35 per cent or better was mined. The manganese minerals are all oxides. The deposits occur in sandstone and chert, and in clays. Those in sandstone and chert fill crevices in the rocks and also chemically replace them; those in clays are nodular in form, originally replacements of shale or argillaceous sandstone. The deposits are associated with certain beds of rock, at various horizons. This is held to indicate that at these horizons manganese was originally deposited more abundantly than at other stages. From this original condition it has been dissolved by circulating ground waters and concentrated in its present form. The total reserves of manganese ore, containing over 35 per cent, are estimated at 92,000 tons. J. E. SPURR.

Technical Papers

Tin and Tungsten—"The Report of the Tin and Tungsten Research Board." 100 pages, is now available from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2, price 3s. 8½d. This board was instituted to improve the methods of treating tin and tungsten ores in Cornwall. The book covers the present practice of dressing tin ores in Cornwall, a report on the microscopic examination of veinstones, and reports of various experimental investigations of proposed methods. Volatilization is discussed at some length.

Smelting Zinc Concentrates—In the October number of *Zinc* (obtainable free of charge from the American Zinc Institute, 27 Cedar St., New York City), O. C. Ralston discusses briefly the excess cost of smelting zinc flotation concentrate. The material is troublesome to handle, and the roasting and smelting furnaces in use are not adapted to treating such fine material without excessive dust losses. Mr. Ralston believes, however, that the construction of special equipment to handle this material economically may not be advisable, with the ample smelting capacity already available and the possible inroads of electrolytic and electrothermic methods.

Rhodesian Mining—The annual report of the Rhodesia Chamber of Mines for 1921, a cloth-bound book of 62 pages, is now available from the Chamber at Bulawayo, Rhodesia.

South African Geology—The Department of Mines and Industries of South Africa has published Geological Survey Memoir No. 18 "A Bibliography of South African Geology to the End of 1920." The publication contains practically a complete list of all articles pertaining to the geology of the Union, Rhodesia, Southwest Africa, Angola, the Belgian Congo, ex-German East Africa, Madagascar, and Portuguese East Africa, arranged alphabetically by authors. It contains 376 pages and may be obtained from the Geological Survey, Pretoria, for 10s. 6d.

Oil Burning—"Modern Oil Burning" is the title of a twelve-page article in the July issue of *Lubrication* (17 Battery Place, New York City; free). The article gives a good summary of modern ideas as to character of fuel and types of burners for both house-heating and industrial furnaces.

Arizona Guidebook — Water-Supply Paper 490-C, published by the U. S. Geological Survey, Washington, D. C., and obtainable on request, is the latest of the series of desert guidebooks being published by the Survey. The area covered in this issue lies in central Yuma and western Maricopa counties, Ariz. The guide is published in the manner made familiar by use in automobile blue-books, and excellent topographic maps are included.

SOCIETIES, ADDRESSES, AND REPORTS

Safety Council Section Meets in Butte

Need for More Safety Work by Small Operator Pointed Out—Underground Refuge Chambers Recommended

More than 100 delegates were present at the first annual conference of the Northwest Mining Section of the National Safety Council, which met in Butte, Mont., on Nov. 20. The conference lasted three days. Delegates were present from mines in Idaho, Montana, South Dakota and Utah.

W. B. Daly, assistant general manager of the Anaconda Copper Mining Co., welcomed the delegates in the name of the Butte operators. He pledged the latter to the safety movement and promised their support to any program that would eliminate accidents. C. L. Colburn responded on behalf of the delegates.

The first session was given over to the consideration of a paper entitled "Putting Safety Over at a Small Mine," by Dr. Arthur L. Murray, who charged the small operator to pay more attention to safety and outlined a complete safety organization for a small mine. It was pointed out in the discussion that followed that little safety work was being done by the small operator.

The second and third sessions were taken up with the subjects of ventilation and fire prevention. "Maintaining Safety Interest in Mines" was the topic of E. J. Rennouard, Jr., safety inspector of the Anaconda company, who spoke at the fourth session. K. T. Sparks, of the Bureau of Mines, presented a paper entitled "First Aid as a Help to Safety."

The fifth and last session was taken up with a description of the safety methods in use at the Bunker Hill & Sullivan, the Hecla, and the Homestake mines, and with talks from the prominent officials who attended the conference.

The following six papers were presented on ventilation and fire prevention:

"Ventilation and Its Relation to Safety," by A. S. Richardson, ventilation engineer, Anaconda Copper Mining Co.

"Refuge Stations and Warnings in Mines," by J. L. Bruce, general manager, Davis-Daly Mining Co.

"Inspection as an Aid to Fire Prevention," by Fred P. Gaethke, safety inspector, Anaconda company.

"Use of Automatic Spray Nozzles in and About Mines," by Angus McLeod, fire chief, Butte & Superior Mining Co.

"Fire Protection Installations About Mines,; What Should Be Fireproofed," by E. M. Norris, assistant general superintendent, Anaconda company.

"What Should Be Done in Case of a Mine Fire," by D. Harrington, supervising mining engineer, U. S. Bureau of Mines.

Mr. Bruce recommended that refuge chambers be constructed underground at places conveniently close to the working places, these chambers to be piped for air and water. In the discussion that followed it was claimed that if the shaft were fireproofed there would be no need of the refuge stations, but Mr. Bruce stated that the fireproofing of the shaft did not entirely remove the hazard; that these refuge stations were inexpensive and would protect the man from noxious gases.

Colorado Mining Men Plan to Meet

The tenth annual meeting of the Colorado Metal Mining Association and the fifth annual meeting of the Colorado Chapter of the American Mining Congress has been called to convene in joint session at the Albany Hotel, in Denver, Jan. 16 and 17, 1923. The announcement says:

"The last year has shown a very decided improvement in conditions affecting the metal-mine operator. Higher prices for the base metals, lower cost for equipment and supplies, more favorable smelting schedules, and decreased freight rates are the principal factors which have led to increased activity in practically all of the leading metal-mining camps of the state. One by one, the distressing problems arising from war conditions are being solved and the industry is rapidly approaching pre-war activity.

"There are yet problems to be solved which can be met only by united action on the part of the mining men of the state. To consider problems confronting the various mining districts; to unite on measures of relief, and to take such other action as may seem expedient or desirable, it is urged that every mining county in the state send a strong delegation to participate in the deliberations and help formulate and adopt concrete plans for co-operative effort during the coming year."

Conference on Numbering of Steel Called by A.E.S.C.

A conference to consider the desirability of providing a system of designating qualities or kinds of steels by code numbers has been called by the American Engineering Standards Committee at the request of the U. S. Bureau of Standards. The conference will be held in the Department of Commerce Building, Washington, Dec. 6.

The subject is of importance to manufacturers and users of steel in large quantity. The conference will attempt to determine the desirability of creating a uniform numbering system.

Columbia Section of A.I.M.E. Meeting With Mining Students

Members of the Columbia Section of the American Institute of Mining and Metallurgical Engineers have arranged a series of meetings with the students of the Idaho School of Mines, University of Idaho, at Moscow, Idaho, and those of the mining department of the Washington State College at Pullman, Wash. As indicated by L. K. Armstrong, of Spokane, secretary of the Columbia Section, the purpose of these meetings is to get in close touch with the undergraduates, in order to inspire in them a deeper interest in their work and impress upon them the best traditions and ideals of the mining professions. The first of these meetings was held at Moscow on Nov. 4, when the students were addressed by the following engineers: Rush J. White, of Wallace, chairman of Columbia Section, who spoke on "Mining Law and Geology"; Fred W. Calloway, of Kellogg, who discussed "Construction of Mine Models"; and E. N. Patty, of Spokane, whose address was on "Magnesite in Washington."

SOCIETY MEETINGS ANNOUNCED

The annual meeting of the **American Engineering Council** will be held on Jan. 11-12 at the new headquarters of the F.A.E.S., 26 Jackson Place, Washington, D. C.

The Boston Section of the American Institute of Mining and Metallurgical Engineers will hold a meeting following a dinner at the Engineers' Club on Dec. 4. Dr. Charles Palache will address the members upon the subject, "South African Diamond Mining."

The National Exposition of Power and Mechanical Engineering will open on Dec. 7, at the Grand Central Palace. It will immediately follow the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers and will remain open until Dec. 13.

Further to enhance the educational and informative value of the exposition the various exhibitors will demonstrate the fundamentals underlying the operation of their apparatus by simulating actual operating conditions as nearly as possible. If practical, apparatus will be shown in motion; otherwise complete diagrams will be displayed.

MEN YOU SHOULD KNOW ABOUT

Frank Nelson, Jr., has been elected president of the Alabama Mining Institute for the coming year.

Richard A. Parker has returned to Denver to resume practice after an absence of nine months in Europe.

R. M. Atwater, Jr., mining engineer, and **Felix Vogel,** geologist, of New York, are visiting various mining districts in Nevada.

D. W. Butner, who has been in Katanga, Belgian Congo, for the last three years, is in New York, on his way to Colorado.

T. S. Woods, of Boston, is in the Michigan copper district visiting the properties of the Franklin and Winona companies.

Louis Levensaler, mining engineer, of Seattle, has recently made an examination of a number of properties adjacent to Valdez, Alaska.

C. T. Brown, manager of the Empire Zinc Co. at Magdalena, N. M., and Hanover, N. M., has been elected state senator from Socorro County.

Robert K. Painter has recently returned to Auburn, Calif., from Texas, where he has been making an investigation of the oil fields in the neighborhood of Laredo.

N. L. Wimnler, of the U. S. Bureau of Mines, who has spent the season investigating placer mining conditions in Alaska, left Fairbanks recently for Berkeley, Calif.

Albert Silver, superintendent of milling for the Tonopah Belmont Development Co., has returned to Tonopah from a six weeks' trip to the company's Surf Inlet property in British Columbia.

Howard Poillion has resigned as a director of the Dome Mines, Ltd., at Porcupine, Ontario. His place on the board has been taken by **D. B. Lee,** president of the Motors Product Co., of Detroit.

Guy H. Moore, former chief clerk at the Zenith mine, at Ely, Minn., has been appointed superintendent of the North Chandler mine, at Ely, to fill the vacancy created by the death of Herbert King.

Alford Roos has gone to Taos County, N. M., to finish his geological work there. He is working out from Dixon on the Embudo River and will return to his home at Bayard, N. M., early in December.

Charles Camsell, Deputy Minister of Mines for Canada, is making a tour of western Canada to study the fuel situation in the Dominion, more particularly with a view of providing Ontario with Canadian fuel.

J. D. Northrop has been authorized to act in charge of the land classification branch of the U. S. Geological Survey in the absence of **Herman Stabler.** Mr. Northrop will retain his duties as chief of the division of mineral classification.

With the idea of gathering information to assist in applying to the best advantage the income from the Belgian relief fund, **Millard K. Shaler,** the American mining engineer who has taken such an important part in the entire movement for Belgian relief, is visiting the principal educational centers in this country. When the war work of the Commission for Relief in Belgium was completed, it was found that a considerable sum of money remained unexpended. This, together with donations received for the purpose, has been invested as an educational foundation. With the income from this investment, thirty-six Belgian graduate students now are being supported in American universities. In addition, important help is being given to the University of Brussels and other schools

Millard K. Shaler

for higher education in Belgium. That this money may be used in the most intelligent manner possible, Mr. Shaler is conferring with educational authorities here. Mr. Shaler began his professional work as a mining engineer with the land classification board of the U. S. Geological Survey. He went to Africa in 1906 with **Sydney H. Ball** for the Forminiere Co. Mr. Shaler took an important part in directing the exploratory activities of this company, which resulted in the discovery and development of the Kasai diamond fields and the operation of other profitable enterprises. Mr. Shaler was later sent to Brussels to serve as the director of the company's technical operations. He has continued in that capacity ever since. Among other things, he directed the work that resulted in the discovery and development of the Angola oil fields in West Africa.

When the Germans invaded Belgium, Mr. Shaler was in Brussels. A fund of $100,000 was hastily raised and placed in Mr. Shaler's hands for the purchase of food.

Throughout the war, Mr. Shaler served as secretary of the Commission for Relief in Belgium. At the same time, he carried on the complicated managerial affairs of his company. For his war service, he was decorated by the king and has become an important factor in Belgian affairs.

Arthur C. James, vice-president, and **William Church Osborn,** general counsel of the Phelps Dodge Corporation, and **T. M. Schumacher,** president of the E. P. & S. W. R.R., were in Dawson, N. M., inspecting company properties, on Nov. 18, and have returned to New York.

F. F. McIntosh, associate professor in metallurgy at Carnegie Tech., has been invited to speak on Dec. 7 before the annual meeting of the American Petroleum Institute at St. Louis. The subject of his address will be "Application of Metallurgical Research to the Petroleum Industry."

E. H. Buckner, of Houston, Tex., vice-president of the Houston Oil Co., was elected president of that company at a meeting of the board of directors at St. Louis, on Nov. 17. He succeeds **Henry J. Bowdoin,** of Baltimore. Mr. Buckner has been engaged in the coastal oil business since 1902.

Daniel C. Jackling left Santa Rita, N. M., on Nov. 18, on his annual hunt in the Black Range. He is accompanied by **John M. Sully,** general manager, and **Dr. F. N. Carrier,** chief surgeon, of the Chino Copper Co., and a party of friends. Forty miles a day for ten days is the schedule set.

The seniors in mining engineering of the University of Illinois, under the direction of Professors **H. H. Stoek** and **A. E. Drucker,** recently returned from their annual inspection trip to the lead smelters and byproduct coke plants near St. Louis, the lead mines and mills of southeast Missouri, and the coal mines and coal-washing plants of southern Illinois.

Walter D. Abel, former assistant engineer of the California State Corporation Department, attached to the San Francisco office, has assumed charge of the Los Angeles engineering branch, succeeding **D. W. Minier,** who resigned. **L. C. Wyman,** a mining engineer of Los Angeles, has also been assigned to the staff of the Corporation Department. Mr. Abel was graduated from the Colorado State School of Mines in 1906, and mined throughout the western states and Mexico, where for seven years he was mining superintendent for the American Metal Co. He also spent considerable time in Arizona and Idaho. Just prior to joining the staff of the State Corporation Department, he was attached to the State Highway Commission engineering staff.

Mr. Wyman is a graduate of the Case School of Applied Science, with the degree of mining engineer. He has been superintendent in mines through the western and southwestern section of the United States, and also has spent several months in the oil fields in and about the Ventura district of California.

Mining and metallurgical engineers visiting New York City last week included **C. H. Suehiro,** of Fukuoka, Japan; **Clifton M. Keeler,** of Washington, D. C.; **Francis C. Frary,** of New Kensington, Pa.; and **L. Wheeler,** of Tampico, Mexico.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

SHUTTING down of properties in outlying districts has helped the labor situation in Butte, though the shortage continues.

The Chile Copper Co. looks for 20,000,000 lb. monthly production some time in 1923.

The Consolidated Mining & Smelting Co. of Canada will resume payment of dividends.

Calumet & Hecla has moved its dredge on Torch Lake to reclaim richer sands during the winter.

The surplus copper in the Lake country has disappeared.

Magnesite mining in Washington is being resumed gradually.

Mining in New Mexico is active, with new operations being started and only one big enterprise—the Burro Mountain property of the Phelps Dodge Corporation —remaining idle.

Japanese copper production is at the rate of 9,000,000 lb. per month; imports are about 4,000,000 lb.

The provincial government of Ontario, Canada, has decided to enforce anti-wildcat laws.

New developments indicate ore in hitherto unproductive eastern part of Tonopah district.

Senator Oddie presents arguments in favor of his gold-bounty bill, which proposes a bonus of $5 per ounce on new domestic metal.

New Developments Make East Section of Tonopah Look Promising

Work in Halifax and Buckeye Mines Indicates Extension of Productive Area in Nevada Silver District

Conditions in Tonopah, the most important mining district in Nevada, are excellent. The productive area of the district has been extended to the east by recent important developments in the Halifax and Buckeye mines. Little work has been done on the new vein discovered on the 800 level of the Halifax, being worked by the West End Consolidated company, which recently acquired nearly all the stock, on account of the necessity for doing considerable dead work to facilitate operations. The crosscut which cut the orebody on the 800 level was driven from a raise, and about 500 ft. of crosscutting was necessary to connect to the 800 station at the shaft. This work is being pushed as rapidly as possible from two faces. The vein has been followed on the 800 level for a distance of 45 ft., all in ore of good grade, and work is to be resumed in this drift.

The Belmont Development company, operating the Buckeye mine, which adjoins the Halifax on the south, is drifting on the 1,400 level, following the vein recently discovered in sinking the Buckeye shaft, and reports the vein to show good values. It is likely that the shaft will be sunk another lift. It is reported that the Belmont is to obtain a two years' lease on the easterly portion of the Eula claim of the Rescue-Eula Mining Co., which adjoins the Buckeye ground to the southwest.

New Guinea Copper Mines, Ltd., Is Spending Money Rapidly

The latest report of the New Guinea Copper Mines, Ltd., states that development of both the Dubuna and Laloki mines is proceeding and that some ore is blocked out. Excavations for the new smelting, converting, and power plants, grading for the smelter railway and preliminary work on ropeway to connect Laloki with the railway, and other expensive preparatory work incidental to completion of the program, is in steady progress. The supply of native labor is satisfactory.

Moffat Tunnel Act Is Constitutional; Construction to Start Soon

The Moffat Tunnel Act was held constitutional by the Supreme Court of Colorado in a unanimous decision announced on Nov. 22. The bill provided for the construction of a tunnel through the Continental Divide, approximately seven miles in length, at an estimated cost of $6,700,000 and authorizes the issue of bonds by a constituted improvement district, including the city of Denver and a strip of territory tributary to the Moffat railroad. The road will open a large mineral territory that has hitherto been handicapped by lack of economical transportation. The bill created the Moffat Tunnel Commission, which is to construct the bore. W. P. Robinson, president of the Board of the Commission, announced that actual construction would begin as soon as the bonds were sold, and that he believed work would start early in January.

Japanese Copper Imports 4,000,000 Lb.; Production 9,000,000 Lb. Monthly

Tariff Equal to 3.37c. per Lb. Holds Price at 16c.—Domestic Industry Fairly Active

Japan's purchases of copper from the United States for the twelve months ending June 1922 amounted to 44,350 tons. This is more than ten times the amount bought during the preceding twelve months.

Such a sudden increase may be regarded as remarkable in view of the fact that the Japanese copper business in 1921 to 1922 was in serious financial difficulty owing to the general slump, according to a dispatch from Reuters.

The increase, however, is partly accounted for by the heavy imports made in March, 1922, just before the new import duty came into effect, raising the copper tariff from 1.2 to 7 yen per 100 kin, or from 0.45 to 3.37c. per pound in American money.

The Japanese copper industry is largely in the hands of four Barons: Iwasaki, Furukawa, Sumitomo, and Fujita. Each has his own mines in the southwestern parts of Japan, and the smelting plants are situated in the neighborhood of Osaka.

The current rate of production is approximately 9,000,000 lb. per month, and the recent monthly rate of imports has been about 4,000,000 lb. and exports about 400,000 lb.

Trading in copper is largely carried on in Osaka, and prices are quoted per 100 kin, or about 133 lb. The current price is about 43 yen per 100 kin, or about 16c. per lb. in American money.

Calumet & Hecla Will Reclaim Copper from Richer Sands

Dredge on Torch Lake Is Moved Shoreward—Steel Work on Tamarack Plant Is Almost Finished

The dredge at the Calumet & Hecla reclamation plant on Torch Lake, in the Michigan copper counties, has been moved closer to shore, in preparation for the winter's operations. The coarser and richer sands lie inshore. The leaching plant, which treats the fine sands, carries a heavier load in summer than in winter, the regrinding plant taking up the greater part of the burden in the cold months. The finer sands in summer yield only 8 or 9 lb. of copper to the ton, but the coarser sands will run 16 to 18 lb., the average for the year's operations being approximately 13 lb., which is recovered at a cost of 4½ to 5c. per lb. Total average recovery now is 1,750,000 lb. of refined copper per month. Although the tailings from the Calumet mill are reground and treated in the reclamation plant, the greater amount of the sand handled comes from the lake. All of the copper oxide now recovered as the result of leaching and distillation is sent direct to the smelter. There is little demand for the oxide in its dry form, although the demand during the war was quite heavy.

Steel work on the new reclamation plant being erected by Calumet & Hecla for the Tamarack conglomerate sands is nearing completion. The plant will be more centralized than that of the Calumet & Hecla proper, in that the leaching, distilling, and flotation units will be under one roof. The regrinding mill is completed, the classifying plant is under construction, and excavating is in progress for the shore plant. The average capacity of the Calumet & Hecla leaching plant is 5,000 tons of sand per day, although it has handled as high as 7,500. The normal capacity of the Tamarack leaching tanks will be under 2,000.

Rich Silver-Lead Vein Opened in American Boy Mine

The American Boy Mining Co., which recently took over the American Boy mine, at Sandon, B. C., has struck a shoot of high-grade silver-lead ore in a winze that is being sunk from the No. 7 level. The winze was started on a stringer, and in 20 ft. it has widened out to 3 ft. A sample taken across the vein gave an assay of 115 oz. of silver per ton and 54 per cent of lead. Exploration work is being done, too, on a stringer found in a crosscut 30 ft. from the main vein. A drift has been run for 20 ft., showing an average of 6 in. of clean galena. If development continues to be satisfactory during the winter, the company proposes to erect a rope tramway to connect with the Sovereign mine tramway in the spring. This will enable the company to ship its low-grade ore to the Alamo concentrator and its high-grade directly to the railway, and thence to Trail.

Clemenceau Invites Clemenceau

The townspeople of Clemenceau, Ariz., and James F. Douglas, president of the United Verde Extension Copper Co., whose immense smelting operations are the only industry of the Arizona town, have extended a cordial invitation to Georges Clemenceau, of France, to visit them. The Tiger was greatly pleased with the invitation and was astonished to learn that a town in the United States had been named in his honor. The original name of Clemenceau was Verde, but there was a Camp Verde in the vicinity, and to avoid confusion the name was changed about three years ago. Clemenceau was chosen by admirers of the eighty-year-old statesman. The employees of the company, to indicate the sincerity of their desire to have the great Frenchman visit them, agreed to contribute one day's wages to a fund to be given to charity, and the mining company offered to add the value of the copper output for one day, which amounts to about $28,000. Although the invitation has not been definitely declined, it is improbable that Clemenceau will be able to accept.

Hollinger Looks for $12,500,000 Gross Output for 1922

With seven weekly periods remaining in the year, Hollinger Consolidated profits to Nov. 11 were $4,850,904.64. This was the strictly operating profit and exclusive of special revenue. If the weekly rate of profit-winning continues to the end of the year, the grand total operating profit will be approximately $5,750,000. Power troubles having arisen, it is possible the costs and tonnage milled will affect the profit as well as the output in the final weeks. However, to Nov. 11, the profits exceeded by $2,083,404 the dividend requirements, which were $2,767,500. The tonnage milled, 1,282,192, indicates the management will almost reach its objective. The aggregate for the year will be around 1,500,000 tons. To the November date, the gross value was $10,977,982.17, the average per ton milled being $8.56, of which approximately 31c. was lost in tailings. Operating costs of $4.4604 compare with $5.2641 in the same period in 1921. The average daily crushing was 4,070 tons. Given immunity from power shortage, the Hollister is within striking distance of a gross recovery for the year of $12,500,000.

New Shippers to Trail Smelter

Four new properties have joined the list of shippers to the smelter at Trail, B. C. From the Slocan district the new producers are the Gem, Noonday, and Ore Bin mines, the Noonday sending the largest shipment, 26 tons. From the Republic district the Quilp sent 104 tons and the Knob Hill 54 tons. Other independent shippers from British Columbia are Alamo, 46 tons, Molly Hughes, 5, Rambler Cariboo, 106, Silversmith, 138; Standard Silver Lead, 180, Van Roi, 46, Whitewater, 27.

New Utah Merger Announces Declaration of Dividend

Park City Mining & Smelting Co. Will Pay 10c. on Jan. 1—Condition of Property Good

The Park City Mining & Smelting Co.—incorporated in February, 1922, to take in the old Daly West and Judge ground, and the entirely undeveloped West Ontario—will pay its first dividend at the rate of 10c. per share on Jan. 1 to stockholders of record Dec. 15. Announcement is made so far ahead, so that the Judge Mining & Smelting stockholders who have not already done so may exchange their stock for stock in the new company in time to profit by the dividend. If all of the Judge stock is converted, the dividend will amount to $87,000. The financial statement accompanying the dividend notice shows net earnings for the quarter ended Oct. 1 to have been $182,699, or at the rate of about $60,000 a month. Ore shipments amounted to 1,869 tons of concentrates, bringing $39.95 per ton; 5,326 tons of crude ore, which brought $43.97 per ton, and 1,384 tons of ore by lessees, which brought $20 per ton. Receipts from ore sales for the quarter were $336,604 and operating expenditure was $157,143.

The physical condition of the mines is shown to be excellent. The new high-grade orebody opened above the 900 level in both the Daly West and Judge properties is giving excellent results. When first opened the orebody was about 6 ft. thick and 25 ft. wide, and it is holding out in size and value with development. A three-compartment raise 250 ft. from the place of discovery has entered ore. The ore as broken in the mine has a value of about $100 per ton. The deposit of high-grade milling ore found on the 1,200 level in the Bonanza Flat section is large; it has been followed for 125 ft. above the level, with ore all the way; and the same ore has been opened 60 ft. below the level.

The company has cash on hand of $375,991 and secured loans $32,928, making a total of $408,920. Other assets include 5,587 tons of zinc concentrate, at present metal prices worth between $60,000 and $70,000; and 335 tons of premium grade zinc, worth approximately $50,000 at present metal prices. Stocks held by the company are 7,500 shares of Park-Utah, which has a market value of around $5.50 a share; 34,000 shares of Daly Mining Co.; and 50,000 shares of New Quincy Mining Co. The company is capitalized at $7,500,000 divided into 1,500,000 shares.

Pittman Act Silver

Purchases of silver by the Bureau of the Mint during the week ended Nov. 25 amounted to 101,536 oz. This brings the total purchases under the Pittman Act to 142,602,412 oz., leaving approximately 65,000,000 oz. still to be purchased.

Miners' Union Executive Becomes Secretary to Arizona Governor

Henry S. McCluskey, president of the Arizona State Federation of Labor and a member of the executive board of the International Union of Mill and Smelter Workers, has been named as private secretary by George W. P. Hunt, newly elected Governor of the state of Arizona. The Governor-elect has announced a policy of encouraging and assisting the mining industry.

Madagascar Exports Rich Uranium Ore—Radium Is Extracted

By Cable from Reuters to "Engineering and Mining Journal-Press"

Paris, Nov. 21—The rich deposits of uranite in the Manandona region of Madagascar and of uranium oxide in the Ankaratra district, discovered two years ago, are being worked. Nine tons of uranium oxide were exported last year, and eighteen tons will be exported this year. It is said that in the near future the island may be able to supply a large part of the world's production of radium.

Spanish Iron Ore Accumulates—Communists Active

Long discussions have taken place at Bilbao concerning the situation of the iron-ore market. It appears that there are more than 2,000,000 tons or ore in the mining depots and that exports during the first eight months of 1922 amounted to only about 1,500,000 tons, compared with nearly three times this quantity in normal circumstances, says a dispatch from Reuters at Madrid.

Some say that the only method of surmounting the crisis and regaining the British and German markets is to reduce wages, but others point out this would hardly be possible, as the difference between the price of the Bilbao ore and that of ore from the Mediterranean coast—Morocco and Algeria—amounts to three pesetas at least, and that labor's share could not be reduced in these proportions. The workers, they declare, must agree to bring their production up to the prewar level, but this solution does not seem capable of early realization, for the men, with some exceptions, still hold to the theory of the least possible effort and the communists among them claim that too much work is being done already, since there are 15,000 men unemployed who would obtain work if individual production were less.

In view of the prevalence of such ideas, there are chances that the price of Bilbao iron ore will long remain above that of competing ores. It is evident, also, that some people, mine owners included, do not yet fully realize that foreigners can buy their ore elsewhere, but the two parties in interest must understand sooner or later, that in order to avoid ruin they must agree to moderate their demands to fit cost prices which will be within the reach of buyers.

Willow Creek Mines Will Operate During Winter

Improved Transportation Facilities Enable Operators in This Alaskan District to Continue Work

Twenty-one properties have been under operation this year in the Willow Creek district, near Anchorage, in Alaska. This means a considerable brightening of conditions in this gold camp. During the summer much road building was accomplished, and the camp is now but one day's ride by train and automobile from Anchorage. Heretofore the district was usually dormant during the winter, but with the improved transportation facilities several of the larger properties are going right ahead with winter operations.

The district is an example of the bad policy of erecting mills before proper metallurgical testing has been done. Attempts are being made to amalgamate an ore which is only in part free-milling. Consequently, a very poor recovery is made on the plates, and the tailings are stored to await the installation of fine-grinding machinery, tables, and flotation. Several companies are installing such equipment.

The Willow Creek Mines Co., under the management of A. T. Budd, is operating a 20-stamp mill on ore from the Gold Bullion, Lucky Shot, and War Baby holdings of the company. It is understood that their operations are yielding a profit. Another well-known perperty, the Mabel mine, is now being operated by Horning & Barthoff.

The Tom Kelley Mines Co. has let a contract for the driving of a 1,500-ft. development tunnel. This exploration will afford additional knowledge as to the vertical range of the pay-shoots.

Shutting Down of Outside Mines Helps Labor Situation in Butte

Mining conditions have considerably improved in the Butte district. Eight hundred more miners are on the payroll of the Anaconda company now than were employed the last week in September. The company is now employing more than 6,000 men in the Butte district, and about 3,000 more are working for the other mining companies of the district. At the Anaconda smelter the total number of men on the payroll of the company is 2,400, the highest number employed since the reopening of the plant last January.

At the Great Falls smelter of the Anaconda company, 1,200 men are working, the zinc department of that plant operating to capacity. Zinc concentrates from the Butte & Superior and the Elm Orlu mines, in Butte, are treated in the Great Falls plant. Ore production in the Butte district has not yet shown material increase with the larger number of men employed, but an increase will be recorded in the reports for November. A greater number of experienced miners are coming to Butte from the outside camps where shutdowns are necessary with the approach of freezing weather.

Portuguese Limit Labor Movement Into South Africa

The restriction on the importation of natives from Portuguese East Africa, limiting their numbers to 250 a week, has become increasingly a matter of comment in mining and commercial circles, says a dispatch from Reuters at Johannesburg. It appears that the restriction is due to a strong agitation for preventing the entry of these natives into the Union on the ground that there already exists a considerable surplus of native labor.

Minnesota Iron Mining Companies Seek Lower Rail Rates

Counsel for the Adriatic and other mining companies on the Mesabi Range in Minnesota that are seeking lower rates on their ore to Lake ports has filed with the Interstate Commerce Commission a bill of exceptions to the preliminary report submitted to the commission by the examiner appointed to take the evidence of the suit. The bill has twenty-three specific exceptions and contends that most of the errors assigned have resulted from a basic and fundamental error pervading the whole report and so influencing the suggested conclusions as to deny to complainants a decision based upon the evidence. It is also contented that the present rate of 91c. per ton contains approximately 27c. of excessive earnings and that from evidence submitted and the application of a strict standard of reasonableness a great proportion of this charge could be eliminated.

New Moctezuma Concentrator Does Excellent Work

The new Phelps Dodge mill at Nacozari, Mexico, is reported operating successfully with 95 per cent of copper extraction from 3¾ per cent ores delivered by rail from the company's Moctezuma mine at Pilares. Success has attended operation also of the new power plant, one of the notable Diesel installations of the southwest. In the mine at Pilares has been developed what is declared to be the largest copper body of the southwest. The property is tapped by a tunnel that reaches the 660 level of the main shaft in the distance of about a mile from the portal, with haulage by electric locomotives. The tunnel runs around the edge of a pear-shaped ore lens, below an immense open stope, from which millions of tons of ore have been extracted.

The main orebody now is 3,200 ft. long and 1,000 ft. wide. Instead of terminating on the tunnel level, it is said to have been demonstrated constant, with about the same uniform value, to the depth of an additional 1,500 ft., by means of diamond drilling. The mine was one in which Dr. James Douglas had a special interest, and he is said to have purchased it in preference to property offered at Cananea. Connection with Douglas and the Copper Queen smelter at that point is had by means of a 72-mile railroad, also owned by Phelps Dodge interests.

Canadian "Smelters" Will Resume Dividends

The promise made at the last annual meeting by J. J. Warren, president of the Consolidated Mining & Smelting Co., of Canada, that dividends would be resumed by the end of this year, will be kept. Next month, it is semi-officially stated, the directors will "declare a dividend," the inference being that the old rate of 10 per cent on $25 parity will not be restored for the time being. "Shareholders will have no reason to complain of this year's business," is the reassuring statement. Canadian Pacific control; the construction of the new concentrator at the Sullivan mine, at Kimberly, B. C.; provision of electric power; and the requirements of various non-producing properties, probably will suggest a conservative dividend policy and the maintenance of a strong cash position. Operations at Trail and the present status of the metal markets provide reason for optimism. With the completion of the Sullivan concentrator, important economies will be in force. The necessity for hauling ore to Trail will be obviated. Added to this will be an ample supply of hydro-electric power. The Trail metallurgical works will be able to undertake custom business on a larger scale than heretofore.

Twenty Million Pounds per Month Goal for Chile Copper

By next year the Chile Copper Co. will probably have brought its production rate to 220,000,000 lb. of copper per year, or almost 20,000,000 lb. per month, according to predictions of well-informed engineers. The company produced approximately 14,000,000 lb. in October.

This figure has established a high mark, and indicates that in the four months to Oct. 31 the mine put out 50,641,000 lb. of metal, or close to the total production of 51,478,000 lb. in the first six months of the year. The company has produced 102,119,325 lb. of copper in the last ten months and there should be no difficulty finishing the year at 130,000,000 lb., the largest output in its history.

Production costs are still hovering around the 6c. mark. Obviously, on the current market, with quotations just below 14c., Chile can make substantial profits, and with the increased output, lower unit costs and greater profit should result.

Because of its declining costs and its ability to sell copper profitably when the majority of producers were unable to "break even," Chile has built up large cash reserves. Its $15,000,000 7 per cent bonds do not mature for six months, but the company has today over $19,000,000 in cash and Liberty bonds and is carrying no unsold copper. Chile's stockholders' list is steadily increasing. Shareholders now number well in excess of 10,000, against 7,300 a year ago.

Steel Interests Are Unfriendly to the Development of Pacific Coast Iron Mining Industry

The Minister of Mines of British Columbia has introduced a bill before the Provincial Legislature, which now is in session at Victoria, to provide $50,000 for the expense of a survey of the iron-ore resources of the province. The Minister refused to place on the "table" the correspondence in connection with the Coast Range Steel Corporation. He averred that Eastern and United States iron and steel manufacturers were unfriendly toward the establishment of an iron and steel industry on the Pacific Coast, and that there were rival interests desirous of finding out what was going on in these negotiations. It was not in the public interest, the Minister declared, to divulge the information at this time.

Gold Dredging May Begin in Old Montana District

Gold dredging on a large scale is to be started in the old Pioneer mining district in Montana, if the plans announced through C. C. Zumwalt, of the Guggenheim interests, and supposed to be acting for Yukon Gold Company, are carried out. The purchase has been announced of the Hennessy & O'Rourke placer claims in that district, the price being from $150,000 to $200,000. According to Mr. Zumwalt, it is planned to spend about $250,000 in improvements and equipment, including the building of a power plant at Divide. From $3,000,000 to $7,000,000 can be extracted by modern methods, according to Mr. Zumwalt, who says that the surface has been merely scratched in that district. The Hennessy-O'Rourke claims have not been worked for the last ten years.

News from Washington

By PAUL WOOTON
Special Correspondent

Oddie Gives His Argument for Gold Bounty

Nevada Senator Would "Conserve Gold Resources of the Nation" by Paying Bonus of $5 per Ounce of New Domestic Gold

IN ADVANCING reasons for the enactment of the bill that he introduced on Nov. 21, to provide a bounty of $5 per ounce on new gold, Senator T. L. Oddie urged that "the deplorable condition of the gold mining industry can be no longer neglected without further heavy losses of our gold reserves and deterioration of plants and equipment, installed and maintained at heavy expense." He declares that gold is the only product whose price is fixed by the government. Confronted by this fixed price for their product and its cost of production, which has greatly increased since 1915, a majority of the "producers of gold have been forced to shut down their mines," which has resulted in a decline in the production of gold from $101,000,000 in 1915 to $50,000,000 in 1921, or about 50 per cent.

The public greatly profits because of the adoption of gold as the monetary unit, and can well afford to adjust the inequities arising from government price fixation for gold, by the payment of a bounty of 25c. per pennyweight for newly produced gold in the United States and its possessions, provided for in the bill. The period for the payment of the bounty is limited to three years, and the manner in which it is to be made will not affect the monetary status of gold nor alter the arrangement under which the gold producer now receives $20.67 per ounce, points out the Senator.

A committee of the Treasury Department early in 1919 reported that production costs were to decline with a general decline in commodity prices and wages, and that, therefore, there was no need for providing special aid for the gold-mining industry. This favorable condition has not, however, been realized; on the contrary, production costs, Senator Oddie maintains, have increased and the production of gold has greatly declined.

Again, when the general drop in prices took place in 1921, the assumption was made that costs of gold production would soon return to normal, and that, therefore, there was no need for providing additional compensation for the industry. The production of gold in 1921, however, was less than that of 1920, thus indicating that the reduction of production costs was not sufficient to exert a stimulating effect upon the industry.

The index number of the Bureau of Labor Statistics has increased from 138 in January, 1922, to 155 in August of this year. Substantial increases of wages in the steel and other fundamental industries recently have resulted in a general increase in the wage level, and the gold producer is now confronted by still further increased production costs. In the present condition of the industry, says Senator Oddie, this increased cost cannot fail to result in the further shutting down of mines, with consequent wastage of ore reserves and rapid destruction of plants and equipment.

The government is wisely making heavy expenditures to conserve the natural resources of the nation. It is, therefore, inconsistent that it should continue to neglect the gold-mining industry, in which the most colossal wastage that has ever been permitted to exist is now taking place. In 1921 gold was produced in twenty states, the

Territory of Alaska, and the Philippines—which unquestionably stamps the stimulation of this industry as one of the national conservation problems.

Having created the conditions, says the Senator, the government should no longer deny the gold-mining industry a necessary adjustment to compensate for the present increased costs of production, but, as a matter of equity and wise public policy, should, without further delay, make suitable provision therefor.

Six More "Get Theirs"

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commissioner has recommended the following awards: Dave Vanella, Nassau, Calif., $310; Hunter & Wilson, Fort Jones, Calif., $197; Delume, Pease & Moran, Iowa Hill, Calif., $421.50, J. A. Mills, Etna Mills, Calif., $280; Wells & Pollock, Yankee Hill, Calif., $441; Alma Davis, Prairie City, Ore., $1,117.93.

Disallowances were recommended as follows: L. A. Jackson, Bluefield, W. Va., commercial import not established; C. P. Haight, Canyon City, Ore., not within the act; Chandler & Haight, Canyon City, Ore., not within the act.

Progress of Drill Steel Survey

Engineers of the Bureau of Mines recently visited the lead mines in Southeast Missouri and obtained detailed information on the heat treatment and breakage of drill steels. At the experiment station at Rolla, Mo., a special furnace has been designed and built for the heat treatment of drill steels under test, and experimental work to obtain fundamental data on the hardening of drill steels is in progress.

Alaskan Bridge Construction Awaits Freezing of River

When the Tanana River freezes over solidly, the finishing touches will be put on the 705-ft. span being used on the Alaskan railroad to bridge that stream. The approaches have been completed and the false work is all in, awaiting the freezing of the river, which will make possible the erection of the structure. It is believed that trains will be using the bridge before the end of the season.

Bureau of Mines Embarrassed by Overwork

Work in connection with the leasing of mineral lands has developed so much more rapidly under the federal leasing act than had been anticipated that the Bureau of Mines is being embarrassed seriously in its efforts to meet the situation. It has been necessary to take men temporarily away from their other duties to help the leasing force and to postpone all but the most urgent work.

It is apparent that it is imperative to have more money for this activity to prevent delays in the carrying forward of mining operations and in the protection of the public's interest.

News by Mining Districts

By Special Correspondents in the Field

London Letter

Burma Mines Report for 1921 Shows Operating Surplus of £497,807—Labor Problem Serious

London, Nov. 17—It is not until shareholders study the full annual report that they realize—and even then in only small measure—what a large and complicated undertaking the operations of the Burma Corporation, in India, have become. Quite apart from its metallurgical department, it has a railway, a forestry department, a housing department, and engineering and medical staffs. Judging by the report for 1921, now to hand, they are all of importance. Despite considerably lower metal prices — silver averaged 36.87d. per ounce, and refined lead £22 14s. 6d. per ton, as compared with 61.56d. and £38 43s. 7d. a year earlier—there was an operating surplus (at 1s. 4d. per rupee) of £497,807, an increase of £42,291. This was due to increased production, 33,694 tons of lead and 3,540,812 oz. of silver, in contrast with 23,821 tons and 2,869,727 oz. in 1920.

No dividend is recommended, as, although the cash position is strong, a reserve fund is to be built up, covering, among other things, the redemption of the debenture loan of £1,000,000. The question of labor bulks large, for an extension of program is dependent upon adequate labor and transport. Relatively little development work was done last year, and after extracting 144,089 tons of ore, the reserves stood at 4,290,358 tons, of an average assay value of 23.0 oz. silver, 25.1 per cent lead, 17.5 per cent zinc, 1.3 per cent copper. Dividing this tonnage, the position is:

	Tons	Silver, Oz.	Lead, Per Cent	Zinc, Per Cent	Copper, Per Cent
Silver-lead-zinc ore	3,954,677	22.9	26.1	18.4	0.47
Copper ore	335,681	23.2	12.8	7.7	11.0

Labor being of migratory character, the average output of ore per total man-shift employed is the low figure of 0.291 tons, though the introduction of the bonus system of payment on results has improved efficiency. Owing to heavy cost of transportation and high returning charges at European zinc-smelting works, the production of zinc concentrates was discontinued. The progress of mill recoveries is indicated by the following comparison:

	Silver, Per Cent	Lead, Per Cent	Zinc, Per Cent
At the end of March	69.8	76.2	52.2
At the end of December	93.0	91.1	77.9

Some weeks ago I referred to the buying of Robinson Deep (Rand) "A" shares of 1s. each. They stand at 35s. The reason for the activity is now known. To provide cash to complete the sub-vertical shaft and to repay the loan to the Central Mining Corporation and the Consolidated Gold Fields, a debenture issue of £200,000, carrying 8 per cent, is to be made. Issue price is £100, and debentures are redeemable every seven years from July 1 next at 102 per cent. This scheme will enable a distribution of profits to be made at an earlier date than would otherwire be possible.

Johannesburg Letter

Shale-oil Prospects—Soda and Salt Refinery Is Being Erected

BY JOHN WATSON

Johannesburg, Oct. 24 — The tenth annual competition for the mine Ambulance Shields, presented by the Chemical, Metallurgical and Mining Society, took place on Sunday morning, Oct. 15, at the Robinson Deep. Twelve teams competed. The judges were Drs. Orenstein, Girdwood, and Watt. For the surface competition, the Modder B team was first with 80.5 per cent marks; the second prize went to Knight Central, which scored 77 per cent.

In the competition for underground teams, the Crown Mines, West, carried off premier honors, with 78.5 per cent, the Consolidated Main Reef team being second with 77.5 per cent.

A slightly colored diamond of 56¾ carats was found by I. L. Priasloo, at the new Kaalplaats diggings. This stone is said to be worth at least £750.

Thirty tons of oil shale were sent to London by the African Oil Corporation at the expense of the Union Government. A report has recently been published that this shale, tested by the Lamplough-Harper process, yielded 50 gal. of oil per ton of shale. The engineer of the Royal Dutch company, after eighteen months' work, determined that there were about 8,000,000 tons of shale yielding about 30 gal. of oil per ton on the property of the African Oil Corporation.

The South African Alkali, Ltd., which has an issued capital of £100,317, is now offering £50,000 in debentures. This company pumps brine and soda solution from the Zoatpan, west of Hamans' Kraal, for the manufacture of sodium carbonate and common salt. A new plant is being installed, which on completion is expected to produce 240 to 300 tons of sodium carbonate and 420 to 540 tons of salt per month.

Montreal Letter

Ontario Government Will Enforce Law, It Says—Weedon Company Dismantles

BY ALEXANDER GRAY

An element of novelty enters into the announcements conveyed through daily newspapers about "the sudden decision of the authorities to enforce the Ontario Companies Act," which requires certain statutory information before advertisements or "dope" literature can be circulated. It appears, in this connection, that "some of the advertisers paid penalties and others contested the cases successfully." Ignorance of the law was pleaded, it is said. Evidently such violations were dealt with without publicity, for this is the first the public learned that any of the glaring offenders had been brought to book. The feline of the species has been promiscuous of late. The signatures of all directors have not been attached to advertisements. Those culpable took it for granted the law was a dead letter, or that immunity was obtainable without the asking. Now, the curb may be applied—but that has yet to prevent malversation. It may restrain. It has not done so. The law was there to enforce. Nor can the excellent Mines Department do everything.

The sale of the Weedon Mining Co. plant at Weedon, Quebec, is notification that the New England-California owners have decided to minimize their interest in that locality. Some time ago they abandoned their zinc-lead-gold-silver property at Notre-Dame Des Anges, in Quebec, where they had a mill. During the war, the Weedon mine was one of the most profitable in Eastern Canada—remarkably so, in view of its modest capitalization. With a stock issue of $50,000, and $200,000 in bonds, annual profits were around $1,000,000, over and above all taxes, costs, and charges. The Weedon was one of those fortuitous ventures that rarely present themselves. Owned originally by Macdonald, it was taken over by John R. Allen, and Dale and Force, of New York and Philadelphia. Somehow its 40 per cent pyrite and 3 per cent copper did not bring success to the enterprise. Through the instrumentality of Leland D. Adams, the superintendent, Gardiner, Me., capitalists were interested. The war brought them exceptional profits, the Weedon mine being one of the largest producers in Eastern Canada, of copper and sulphur. For years, however, operations have remained suspended. The action of the owners and the waiting policy at Eustis and Capelton leave Quebec copper production a negligible quantity, for the time being. Meanwhile present owners contemplate re-starting the Notre-Dame Des Anges zinc-lead mines.

Expeditions into Labrador bring glowing reports of extensive placers. It is planned to test these next spring. Initial results are said to warrant this, although climatic difficulties are not being overlooked. Another Klondike whets the fancy, even though there be tang in the country around Bog Brook River on the north coast of Labrador, 700 miles from St. John's, Newfoundland. The deposits are said to be glacial, and are found at right angles to the present creek, evidently in old river bottoms. Considerable ground has been acquired, notwithstanding Boreas has it much his own way up there, but first clean-ups may not be representative. Private advices state that already vessels are being fitted out.

ONTARIO

Dome Has Highest Heads at Porcupine

Cobalt—The Cane Silver property, in the Elk Lake district, is being reopened. During October the Nipissing mined ore of an estimated net value of $151,665, and shipped bullion and residues of an estimated net value of $228,579. The mine and mill were closed down for about ten days, due to the fire, and production for the month was restricted on this account.

Kirkland Lake—The Teck Hughes is understood to have cut a new vein on the 700 level. Mill heads are running unusually high.

The Columbus-Kirkland is a new company which will develop claims near the Teck Hughes.

Crown Reserve has cut 22 ft. of ore on the 300 level of its Pan Cake Lake property, of which the first 12 ft. averaged $10 per ton.

Porcupine—Mill heads at the Dome are the highest in the Porcupine district. Production is being maintained at approximately $400,000 per month. A new crusher has been put in operation on the 12th level, and will handle the ore between 850 ft. and 1,450 ft.

BRITISH COLUMBIA

Nickel Plate Will Shut Down for the Winter—Reco To Be Developed

Princeton—The Hedley Gold Mining Co. purposes to close the Nickel Plate mine and mill during the coming winter, as for the last two months the mine has paid only a little more than operating expenses, and in the previous four months it was worked at a loss. The mine will be reopened in the spring. The operating expenses are considerably more in winter than throughout the rest of the year. During the past season considerable diamond drilling has been done, but as yet it is too soon to correlate the results. Some holes found good ore; others were disappointing.

The Susie group, in the Fairview district, which is controlled by H. A. Guess, of the American Smelting & Refining Co., is being reopened, after a long period of idleness. Arrangements have been made with the West Kootenay Power & Light Co. to construct a high-tension line from Oliver to the mine, to provide for mining and milling operations.

Nelson—Reco Mines, Ltd., has began the development of the old Reco mine at depth by two adits that will give depths of 1,500 and 1,900 ft., respectively below the discovery outcrops. The whole of the lead ore in the upper part of the mine has been stoped out, but some silver-zinc ore has been left in the stopes, and an attempt will be made to recover the best of this ore, at any rate. The Reco was bonded to the late James Dunsmuir, who proposed to work it in conjunction with the Noble Five mine, but his executors allowed the bond to lapse after his death.

A compressor is being installed at the Mollie Hughes mine, near New Denver, to hasten the sinking of a winze from the 300-ft. crosscut. The oreshoot on the Mollie Hughes, though narrow, is believed to be the longest in the Kootenays, being continuous for 900 ft. in the bottom level. An unusual feature of the ore is that, though the main value is in silver, it often contains from $20 to $30 per ton in gold.

MEXICO

Government Officials Assure Investors of Ample Protection in Oaxaca

Oaxaca—The Sierra Juarez district is quiet. The famous Natividad mine is idle, but reports say that the owning company is planning to resume operations soon. Several Americans have recently denounced properties abandoned by non-payment of taxes, and work on a small scale is being done. Isaac Ibarra is working on old tailings.

The 200-ton mill at the San Martin mine, in the San José district, is still idle, due to the inability of the railroad to supply fuel oil. However, the railroad situation is improving steadily. The San Juan mine, in this district, is being unwatered by Los Angeles people, who have erected a steam hoist.

In the Taviche camp, the mines that are producing and shipping to the smelters are the San Juan, Escuadra, and Thompson properties. High-grade ore is being extracted, but the conditions imposed by the ore buyers are onerous. The reported reopening of the A. S. & R. Co. smelters is anxiously awaited. The San Juan mine is shipping, but plans the erection of a 100-ton flotation plant with Mexico City capital.

The Mexican Corporation, of which Hugh Rose is general manager, has secured options on the properties of the American Consolidated Co. (Texas company) and has had its engineers on the ground for some time.

Political conditions are about normal here. Governor Garcia Vigil has conducted a vigorous campaign against the old-time bandit bands, and has exterminated them. Governor Vigil is progressive, and desirous of having American capital invest here, assuring protection and good treatment.

J. Emerson Gee is working his mine and mill in the Toojomulco district, and has denounced considerable new ground.

The Totolapa district is quiet, the only property working there being the McEwen mine and mill.

ARIZONA

Phelps Dodge Plans Connections Between Morenci Mines

Superior—Rapid progress is being made on the construction and development program now being carried out by the Magma Copper Co. Steel has been laid upon the new standard-gage railroad for a distance of eight miles north of Magma Junction, the point where the line joins the Arizona Eastern R.R. The right of way, which follows the route of the narrow gage, except for a few places where changes have been made, is practically all graded, and it is expected that the road will be completed early in February.

Morenci—A two-year program has been mapped out by the engineering department of the Phelps Dodge Corporation, Morenci branch, which provides for connecting the mines of the company with those purchased last year from the Arizona Copper Co. and a co-ordinated system of stoping and development of the properties. No. 6 concentrator is to be kept in operation, but no likelihood exists for early resumption of the Clifton smelter. The concentrates run high in sulphur and are of the character needed for fluxing by the Douglas smelter. The Douglas works are being run at hardly more than half capacity and can handle the Morenci output at a much lower cost than could the Clifton plant.

Globe—A crew of the Southwestern Wrecking Co. has arrived in the district and will proceed to dismantle the plant of the Arizona Ores & Asbestos Co., situated in the Sierra Anche. About fifteen men will be employed.

The Dripping Springs Copper Co. has started diamond drilling on its property at Dripping Springs. Two holes are to be drilled to the depth of 1,000 ft. The first hole is being started from the main tunnel at a point 500 ft. below the surface. In driving this tunnel, which is three-quarters of a mile long, several veins of carbonate ore were cut, from which thirty cars were shipped during the time when the copper market was good. This ore averaged 7 per cent copper and contained some chalcopyrite. The Dripping Springs mine is equipped with a compressor, a Deisel engine, and a gas engine.

CALIFORNIA

Idaho Maryland Is Opening New Oreshoot

Special San Francisco Correspondence

San Francisco—Prospecting permits have been obtained for the investigation of coal lands in Kern and Monterey counties. W. R. Moorehead has been made receiver for the New Idria Quicksilver Mining Co.

Grass Valley—A new orebody has been discovered in the Idaho Maryland. The vein was struck in the Dorsey Winze at a depth of 1,900 ft. It is in virgin ground. Development to determine its importance is now in progress.

New buildings and bins are to be constructed at the Grass Valley Boundary mine before starting new development.

Improvements in the surface plant and shaft of the Alcalde have been made, and mining is to be resumed.

At the Canade Hill mines, in upper Placer County, twelve men are at work, and it is expected that sufficient ore will be developed during the winter to warrant beginning milling.

Jackson—The Kennedy Mining and Milling Co. is now operating 60 stamps and will soon be in a position to operate more. The Marklee Mining Co. has been reorganized for the reopening of the Marklee mine, four miles north of Volcano. J. L. Del Monte has purchased the property and has secured capital to begin operations.

NEW MEXICO

Mining Industry Is "Picking Up"

BY JAMES P. PORTEUS

General conditions throughout the mining districts of the state are improving. Copper quotations below 14c. seem to cause no anxiety. The 10 per cent increase is wages that became effective recently has had the effect of bringing skilled white miners to the state, and there is a steady influx of common labor and miners from Mexico, where conditions are reported bad owing partly to the drastic employment laws in Chihuahua.

The Chino Copper Co. is working seven steam shovels. About 600 men are employed at the mines at Santa Rita and 200 at Hurley, where one unit of the four-unit concentrator is working two shifts. Normally the company employs 2,000 men. At Fierro the Hanover Bessemer Iron & Copper Co. has 200 men on its payroll.

The Hecla Divide Co. is driving an 8,000-ft. drainage adit in the Pinos Altus, planning to unwater a number of old gold-silver-lead mines. The Mogollon Mines Co. is employing 100 men. S. J. Kidder, the manager, reports unusual success in locating orebodies.

At Lordsburg the Calumet & Arizona Co. is shipping 7,000 tons of siliceous copper ore monthly from its 85 mine, this ore going to the smelter at Douglas. A new 300-hp. Nordberg electric hoist has just been installed. Pneumatic flotation equipment has been installed in the 65-ton mill of the Last Chance Co.

The only big property that is not working is the Burro Mountain Branch of the Phelps Dodge Corporation, where only pumps are operating, and the plants are ready for operations on short notice.

The old Graphic mine at Cook's Peak, near Deming, will be reopened by Sam L. Houghton, recently with the United States Smelting Co. at Fierro, and George L. McCann, of the Chino Copper at Santa Rita. This property was worked during the 80's, and is said to have produced 700,000 tons of ore. The new management will employ 100 men, starting development work on the 725 ft. level.

NEVADA

Nevada Consolidated Mills 2,400 Tons In Two Rebuilt Units

McGill—The Nevada Consolidated Copper Co. is now treating approximately 2,400 tons of copper ore daily In the reconstruction following the fire of last July, two units are completed, and each handles about 1,200 tons daily. It is expected that five units will be operating soon after the first of the year. This will give a daily capacity of 6,000 tons. It is believed that this capacity will be maintained until improved markets justify completion of the three other units under consideration, making an ultimate capacity of around 10,000 tons daily. The high-grade orebody in the Ruth mine continues to produce well.

Divide—Production of the Tonopah Divide mine for October was 1,492 tons, of an average value per ton of $26.92. Shipments were increased on Nov. 1 to 60 tons per day. No change has been reported on the 1,200 level; the crosscut has been in low-grade vein material for 20 ft., and drifts to the southeast and northwest have been started. The southeast drift has at least 250 ft. to go before reaching the projected position of known orebodies.

Royston—Lessees working from the 320 level of the Hudson mine recently shipped a 40-ton car of ore which will run about $250 per ton. The main shaft is now being sunk from the 400 to the 500 level on contract.

COLORADO

Standard Chemical Co. Shuts Down Carnotite Properties

Naturita—John I. Mullen, general superintendent of the Standard Chemical Co., which has been operating carnotite properties in Montrose County, announces the closing down of the plant for at least two years, or until the demand for radium or its products justifies resumption. The plant has been operation for the last ten years, furnishing employment for from 100 to 250 men, with an average expenditure, according to Mullen, of $500,000 annually.

Cripple Creek—The El Paso mine, which has been closed down for several years, will be reopened at once, according to an announcement made by John H. Nichols, superintendent of the El Paso Consolidated Mining Co. Approximately $50,000 will be expended in putting the property in condition for operation; this will require two or three months to complete. The property will be open to leasers as soon as the preliminary work is finished; but certain blocks will be reserved by the company for development on company account.

A promising body of ore running about $50 per ton has been opened up in virgin ground on the Doctor Jack Pot. Lessees on the Maggie claim owned by the Cresson company are shipping 11-oz. ore from a new discovery near the surface.

MONTANA

Davis Daly Made New Production Record in October

Butte—A new record for production was made in October by the Davis-Daly Copper Co., which sent 21,000 tons of ore to the Pittsmont smelter. As the mine is not worked on Sundays, the October output was at the rate of nearly 1,000 tons daily.

Of this tonnage, 15,000 was mined in the Colorado mine and 5,500 tons came from the Hibernia. The latter property is one of the richest silver mines in the Butte district.

Nothing is showing on the surface of any move toward a settlement between the Davis-Daly and the Anaconda companies of the dispute over orebodies. A large staff of experts employed by the former company has gone over every inch of the ground involved and has left to prepare reports. There is no indication that either side has made a move toward starting litigation.

In the first fifteen days of November the Emma mine of the Anaconda company produced 3,000 tons of zinc ore, which was shipped to the Great Falls smelter. The Emma also forwarded considerable manganese ore to Great Falls. The Anaconda company is developing in the Moonlight mine, which has been shut down for four years. About sixty men are employed in the work.

Deer Lodge—The Champion mine of the Butte-Jardine Metals Mines Co. is producing eighty tons of milling ore daily, assaying 13 oz. silver. This capacity will be increased to 120 tons. The mine is employing 120 men.

UTAH

Utah Copper Co. Is Increasing Output of Magna Mill

Park City—Shipments for the week ended Nov. 17 amounted to 3,418 tons, compared with 3,772 tons the week preceding. Shippers were: Park City Mining & Smelting, 1,121 tons; Silver King Coalition, 1,050; Park-Utah, 853; and Ontario, 394 tons.

Bingham—Shipments for the week ended Nov. 17 amounted to 88 cars (shipments by Utah Copper and Utah Consolidated not given here). Shippers were: United States Mining, 50 cars; Utah Apex, 22; Bingham Mines, 10; Montana-Bingham, 6. The Ohio Copper is making a shipment of 30 tons of cement copper from its leaching operations. A similar shipment was made two weeks ago.

Garfield—At the Magna mill of the Utah Copper, a second flotation unit has been put into operation, and a third is expected to be ready for operation Dec. 1. It is understood that a new unit is expected to go into operation every two weeks until a capacity of twelve units is reached. Each flotation unit has a capacity of 1,000 tons of ore daily. At present the Magna mill is employing 500 men, of whom 200 are employed in milling and 300 on construction.

Eureka—Tintic shipments for the the week ended Nov. 17 amounted to 150 cars. Shippers were: Chief Consolidated, 52 cars; Tintic Standard, 43; Dragon, 14; Eagle & Blue Bell, 9; Victoria, 9; Iron Blossom, 9; Colorado, 7; Empire Mines, 3; Swansea, 3; Bullion Beck, 1.

The Iron King is making preparations for beginning the shipment of fluxing iron ore. The Iron Blossom has just made a small shipment of exceptionally rich ore, which will bring in a considerable sum of money.

Marysvale—Work is being done at the American Consolidated (formerly the I. X. L.) mines adjoining the Deer Trail. Fred Dern, of Salt Lake, is manager.

Alta—The South Hecla Mines, a consolidation of the South Hecla with other Alta properties, is levying an assessment of 1c. a share. Reasons for this are said to be debts of companies going to form merger; additional sums for income tax; and hindrance of operation in Rustler and Skipper fissure stopes of the South Hecla from gas and water.

MICHIGAN

Surplus Copper in Lake Country Has Disappeared

Houghton—Dec. 1 probably will see the docks in the Michigan district bare of surplus copper. November business is brisk, deliveries having been made in large volume. Export trade, so far as Lake copper is concerned, is picking up. France is taking the bulk of this metal, although Germany, Belgium, and the Scandinavian countries also are in the market. At the Calumet & Hecla smelter, sixteen furnaces are in operation. The electrolytic plant has been shut down to await a new supply of cupola blocks, which are smelted into anodes from which the silver is extracted by electrolysis. The electrolytic plant has been in operation continuously, treating the anodes made from a large accumulation of cupola blocks.

Gogebic Range

Ironwood—The last cargo of ore from the Gogebic Range was shipped from the docks at Ashland on Nov. 23. It was from the Sunday Lake mine, at Wakefield. This does not, however, end shipping, as for several years past a considerable tonnage has been shipped "all rail" from this range. Most of this has been from the mines of the Steel & Tube Co. of America, and has gone to that company's furnaces at Mayville, Wis., and Chicago; also, some ore has been shipped to St. Louis. Last season about 250,000 tons of ore was shipped "all rail."

"C" shaft of the Pabst mine has been closed permanently. It was the last hanging wall shaft of the Norrie-Aurora-Pabst group to be abandoned. Two others, the Corry shaft of the East Norrie mine and "A" shaft of the Aurora mine, were closed down within the last four years. All had been pulled out of line by mining operations despite pillars to support them. For that reason and to recover the considerable tonnages of ore contained in the shaft pillars, these old shafts were all replaced by new shafts back in the foot wall.

MINNESOTA

Mesabi Range

Second Shift at Bennett Mine Will Employ 200 More Men

Marble—Stripping operations at the Marjorca mine, operated by the Pickands-Mather Co., has been resumed. The new work will uncover additional ore beyond the original pit limits. It is anticipated that this work will continue through the winter.

Eveleth—The mines of the Oliver Iron Mining Co. in this vicinity have concluded their shipments for this season with a total of 2,850,000 tons, which compares favorable with past years. Stockpiling of the ore has been started at all of the underground properties, and three shovels are removing strippining in the Leonidas pit and four in the Spruce pit. It is planned by the company to keep all underground operations to full capacity, and some development work will be undertaken in the underground workings of the Leonidas mine.

Keewatin—The Pickands-Mather Co. has announced that operations at the Bennett mine will be increased to a double shift basis as soon as the required men can be obtained. The addition of a night shift will give employment to over 200 men, and according to present plans the operations will be pushed to the fullest extent.

Nashwauk—All ore shipments have been completed by Butler Bros. at the Harrison and Patrick open pits, and the washing plants serving the two properties are now closed for the winter months. The concentrates which were stockpiled during an acute car shortage were also shipped at the latter part of the season. One steam shovel is taking clean-up cuts in the Patrick pit.

Vermilion Range

Ely—The shipments of ore from the various mines is practically complete, and stockpiling is being done at all of the mines except the North Chandler, whose total production of 200 tons per day is being sent to the Zenith Furnace Co. at Duluth. The Pioneer mine, a property of the Oliver Iron Mining Co., was the largest shipper, with 600,000 tons, and the Zenith mine, operated by the Pickands-Mather Co., shipped 250,000 tons. Total shipments from this district were 1,200,000 tons, which includes the above mines, and also the Sibley, Section Thirty, and Soundan mines.

There has been no resumption of work at the South Chandler mine, which has been closed for two years, but stockpiling of ore is in progress at the Armstrong Bay mine, and no doubt this property will enter the shipping list next season, as the spur track to the property has been completed.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
23	13.625	35.25	36.00	7.00@7.20	6.90	6.85@6.90
24	13.625	35.25	36 00	7.10	6.925	6.80@6.85
25	13.625	35.25	36.00	7.10	6.95	6.95@7.00
27	13.625	35.25	36.50	7.10	6.95@6.975	6.95@7.00
28	13.625	35.25	36.50	7.10	6.95@6.975	6.95@7.00
29	13.625	34.75	36.00	7.10	6.95@6.975	6.95@7.05

*These prices correspond to the following quotations for copper delivered: Nov. 23 to 29 inc., 13.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Federal bureaus in Washington which are interested in the mining industries.

London

Nov.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
23	62	63	70	174½	175¾	26½	25⅛	36	34⅜
24	61⅝	62⅝	69½	174½	175⅝	26¼	25⅛	36⅛	34⅜
27	61¾	62⅝	69¼	174¾	175¾	26¼	25¼	36⅜	35
28	61½	62⅜	69¼	174⅝	175⅝	26¼	25¼	38⅜	35½
29	61⅝	62⅜	69¼	174	175	26⅛	25¼	39	35¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Nov.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
23	4.49¼	99¼	64½	32½	27	4.50¼	99¼	64¼	32 3/16
24	4.49⅛	99¼	64¼	32 5/16	28	4.51⅛	99¼	63¾	31⅞
25	4.49⅜	99¼	64½	32 7/16	29	4.51⅞	99¼	64¼	32 1/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

Copper, zinc, and tin have been in small demand during the last week, and with the Thanksgiving holiday tomorrow, not much business can be expected until Monday at least. Lead has continued strong. Among the less important materials, the arsenic market is the feature, supplies being exceedingly scarce and the price rising beyond the wishes of the principal producers.

Copper

There are more sellers at 13¾c. delivered today then there were a week ago, and there is no difficulty in getting large amounts of copper for delivery over the next two or three months at this level, where the freight rate is not more than 25c. per 100 lb. On some desirable business this price has been shaded to 13.80c. Also, two or three lots have been offered by second-hands, and this metal is reported to have been obtainable at 13.75c. delivered. There is not as much of this available as is usual at the end of a month, however. On the other hand, some producers have done business as high as 14c., a sale having been made yesterday at that level, and where the freight rate was not above normal too.

Export demand has been quiet, but the prices have been satisfactory, compared with the domestic market.

Average Metal Prices for November

Copper:	
New York Electrolytic	13.598
Lead:	
New York	7.047
St. Louis	6.868
Silver:	
New York, foreign	65.177
New York, domestic	99.250
Sterling Exchange	447.484
Zinc:	
St. Louis	7.104
Tin:	
99 per cent	35.911
Straits	36.734
Antimony	6.584
Quicksilver	71.521
Platinum	108.000

Lead

The official contract price of the American Smelting & Refining Co. was advanced from 7 to 7.10c. on Nov. 24.

The advance of the Smelting company brought its price about to the level of outside interests for December and January lead. At the new level, lead was in freer supply and more was sold for Eastern delivery than for some weeks. For prompt and spot lead, premiums continue to be asked, and 7.25c. would no doubt have to be paid, though practically none is being sold, so that the influence of this price on the major market is practically nil. The St. Louis market has been dull; today some quotations as high as 7c. are heard, but this figure could be shaded on actual business.

Zinc

After sagging last Thursday and Friday, the market recovered quickly, and prices today are as high as 7.05c., which was received for some sales. The uneven market of the last two weeks was probably caused by international speculative trading in the absence of American consuming demand. The statistical position of zinc is sound and offered no excuse for the decline in price. New York prices continue 35c. per 100 lb. above St. Louis levels, and in the East high-grade continues at 8.25c. per lb. delivered.

Tin

Consumers continue out of the market, and there is little interest in tin. Competition with Chinese brands has forced the price of 99 per cent grade to more than a cent below the price of Straits. Slow unloading made a slight scarcity in the supply of Straits for spot delivery, but the condition is temporary and unimportant. There is practically no difference between the prices asked for December and February tin.

Arrivals of tin, in long tons: Nov. 1 to 28, 4,652.

Gold

Gold in London: Nov. 23d, 91s. 8d.; 24th, 91s. 9d.; 27th, 91s. 7d.; 28th, 91s.; 29th, 91s. 1d.

Foreign Exchange

Sterling has been particularly strong, but other exchanges did not share in the advance to any particular extent. On Tuesday, Nov. 28, francs were 6.98c.; lire, 4.77c.; marks, 0.0125c.; and Canadian dollars, ¾ per cent discount.

Silver

The London market touched a new low level for the year on Nov. 28, but the advance in sterling exchange counteracted to some extent in New York the effect of this fall. There was some slight recovery on the 29th, but the market closes with a weak undertone.

Mexican Dollars—Nov. 23d, 49¼, 24th, 49; 25th, 49¼; 27th, 49; 28th, 48⅝; 29th, 49.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—General market for 99 per cent grade, about 22@23c. per lb. London quotations, £92 10s.

Antimony — Chinese and Japanese brands, 6.50c.; quiet. W. C. C., 6.75@7.25c. Cookson's "C" grade, spot, 8⅝@9c. Chinese needle antimony, lump, nominal, 4.50c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5¼c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 6.75@7c.

Bismuth—$2.45 per lb. London quotes 10s.

Cadmium—$1.15 per lb. London quotes 5s. 6d.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2 per lb. in bbls. London quotes 11 to 12s. for metal; black oxide, 9s.

Iridium—$240@$275 per oz.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, $1.25 per lb. London quotes 4@4s. 9d. for 99 per cent.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage. Powder, 95 per cent, $4.50 per lb.

Monel Metal — Shot, 32c.; blocks, 32c. per lb., f.o.b. Bayonne, N. J.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market quiet at 32@34c. per lb.

Osmium—Pure, $70@$80 per oz. troy, in Los Angeles. Strong.

Palladium—$60 per oz. London, £17@£19 10s.

Platinum—$108 per oz. London, £23.

Quicksilver — $71@$72 per 75-lb. flask. San Francisco wires $70.70. London, £12.

Radium—$70 per milligram of radium content.

[1]**Rhodium**—$100@$115 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $1.90 per lb.

[1]**Tellurium**—$2.50 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, $1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Indian chrome ore at $18.50 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $28 per ton. Market quiet.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $5.95; Mesabi bessemer, 55 per cent iron, $5.70; Old Range non-bessemer, 51½ per cent iron, $5.20; Mesabi non-bessemer, 51½ per cent iron, $5.05.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5 per long ton; old bed concentrates, 63 per cent, $5.25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.

Manganese Ore—30c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, $75@$80 per gross ton.

Molybdenum Ore—60c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty; equivalent to 85@90c. per lb.

Tantalum Ore—Hand-sorted ore, 70 per cent combined columbite-tantalite, 40c. per lb., South Dakota.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 96 per cent TiO_2, 10c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore — Wolframite, $7.50; scheelite, $8@$8.50 per unit of WO_3, f.o.b. New York.

Uranium Ore (Carnotite)—Ore containing from 2 to 2½ per cent U_3O_8, $3.50 per lb. of contained U_3O_8.

Vanadium Ore—No quotation. Recently $1 per lb. of V_2O_5 content.

Zircon — Zirconium silicate, f.o.b. Pablo, Fla., 4½@13c. per lb.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 25—Zinc blende, per ton, high, $47.50; basis 60 per cent zinc, premium, $45@$44; Prime Western, $43@$42; fines and slimes, $41@$39; average settling price, all grades of blende, $42.32. Calamine, basis 40 per cent zinc, $22@$24.

Lead, high, $93.60; basis 80 per cent lead, $93. Average settling price, all grades of lead, $88.10 per ton.

Shipments for the week: Blende, 17,282; calamine, 125; lead, 2,137 tons. Value, all ores the week, $922,330.

Shipments for eleven months: Blende, 414,073; calamine, 2,034; lead, 81,731 tons. Value, all ores eleven months, $19,565,560.

The zinc shipment was larger than that for any other week this year, and also larger than that of any other week since March, 1920.

The railroads made a ruling that car distribution would be on the basis of ore purchased, resulting in unusually large purchases during November. The Northeast Oklahoma railroad has secured a large number of eastern flat cars, is boarding the sides, and supplying these cars to shippers, thus accounting for the larger shipments for the last two weeks. It is proposed to use them for short deliveries to the smelters for a few weeks, and then to load them with metal for their return east.

The weakened tendency of slab zinc reacted on the ore market, with reductions of $2 to $3 per ton. Lead was again strong, with a 50c. advance.

Platteville, Wis., Nov. 24—Blende, basis 60 per cent zinc, $45 per ton. Lead, basis 80 per cent lead, $93 per ton. Shipments for the week: Blende, 521 tons; lead ore, none. Shipped during the week to separating plants, 989 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $650@$700; No. 2, $350@$400; long spinning fibers, $165@$275; magnesia and compressed sheet fibers, $125@$175; shingle stock, $60@$90; paper stock, $30@$45; cement stock, $15@$20; shorts, $7@$12—all per short ton, f.o.b. mines, Quebec.

Rhodesian No. 1 crude, $400; No. 2, $275 for best quality, c.i.f. New York.

Producers report crudes and spinning fibers quiet; shingle, paper, and cement stocks show strength and activity. Rail embargoes are troublesome.

Barytes—Crude, $8@$8.50 per ton, f.o.b., mines. Ground, off color, $13@$14; white, $16@$17, f.o.b. plant. Prime white floated, $24@$28 per ton, St. Louis.

Demand is good and seems to be in fair way to hold up for some months to come.

Bauxite—American, crushed and dried, $6@$9 per gross ton; pulverized and dried, $12@$14 per gross ton; calcined, $22@$25 per gross ton, all f.o.b. shipping points. Foreign bauxite offered at $5@$8 per metric ton, c.i.f. Atlantic ports, depending upon grade.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5¼c. per lb.; in bbls., 5½c. Boric acid, 11c.

Chalk—English, extra light, 5c. Domestic light, 4½@4¾c.; heavy, 3½@3¾c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6@$8; washed, $8@$9; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $14@$20, f.o.b. Virginia points. Imported lump, $14@$20, f.o.b. American ports; powdered, $40@$45, f.o.b., New York. 1A grade, refined, $14@$15 per ton, Delaware.

Canadian, in lumps, $16@$18, f.o.b. Quebec points. Demand good.

Diatomaceous Earth — Crude, air-dried material, in large lumps, $8 per ton, f.o.b. California quarries. Ground material for insulation is priced according to density. It is being sold for $35 per ton, having a settled weight of 15 lb. per cu.ft., and $25 per ton for 20 lb per cu.ft. The highest grade of material, the so-called "air float" or "baghouse," suitable for polishes and similar uses, brings from $75 to $100 a ton. All prices f.o.b. quarry. Material suitable for filtration is not in line with the other grades of powders. Contracts

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

with large consumers are at present in force at a figure as low as $17 per ton, f.o.b. quarries. It is doubtful, however, if contracts could be made at present at less than $20 or $22.50 per ton. The prices quoted on this grade of material depend largely on estimated consumption of the purchaser. All above quotations are on a minimum car basis, a minimum car holding 20 tons of 2,000 lb.

Emery — Turkish and Greek manufactured emery, 6@8c. per lb. American, 3½@5½c. Inferior grades, 3½c., f.o.b. New England points.

Feldspar — No. 1 pottery grade, $5.50@$7.50 per long ton; No. 2, $5@$5.50; f.o.b. North Carolina points. No. 1, $7.50; No. 2, $6.50; ground, 60 to 80 mesh, $18@$20 per short ton; 120 to 150 mesh, $20@$24; 200 mesh, $25@$30; f.o.b. Connecticut points. No. 1, Canadian, $20 per net ton, f.o.b. Ohio mills.

First quality ground, $21 in New Hampshire, $18 in Maine; second quality, $16 in New Hampshire. In Colorado, No. 1 crude, $5; No. 2, $4.50 per short ton.

Potters' strike is affecting all producing centers. Market quiet.

Fluorspar — Fluxing gravel, 85 per cent CaF_2 and not over 5 per cent silica, $21.50, f.o.b. mines; not over 6 per cent silica, $21; 80 per cent grade, not over 5 per cent silica, $20; ground acid grade, $45 in bulk; ground enameling grade, $35 in bulk; packages, $4 extra, all f.o.b. mines, Illinois.

No. 1 lump, $30; No. 2, lump, $25, f.o.b. Illinois mines.

Fuller's Earth—16 to 60 mesh, $19 per ton; 16 to 30 mesh, $17; 30 to 60 mesh, $18; 60 to 100 mesh, $14; 100 mesh and finer, $10; f.o.b. Florida mines.

Graphite—American flake, 4@5c. per lb. at mines. Ceylon lump, first quality, 5@5½c. per lb., plus duty; chip, 4@4½c.; dust, 3@3½c. Mexican crude amorphous, $15@$35, f.o.b. New York.

Gypsum—Crushed rock, $3 per ton in most states. Ground, $3.50@$4, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. and larger, $1.10 @$1.35 per net ton. Agricultural limestone, $2.50@$3 net ton, f.o.b. eastern shipping points.

Magnesite—$15 per ton for crude, $37.50 for calcined magnesite, f.o.b. California points. Northwest American magnesite industry shut down. Dead-burned magnesite grains, $43.50 per net ton, f.o.b. Baltimore; $45, Chester, Pa.

Mica—Domestic, No. 1 quality, 1½x2 in., 15c. per lb.; 2x2 in., 35c.; 2x3 in., 80c.; 3x3 in., $1.20; 3x4 in., $1.60; 3x5 in., $2; 4x6 in., $2.80; 6x6 in., $3.60, all per lb. f.o.b. North Carolina; thumb trimmed; 1¾ in. disks, 75c. per lb.

[1]**Monazite**—Minimum 6 per cent ThO_2, 6@8c. per lb.

Phosphate — 77 to 76 per cent tricalcium phosphate, hard rock, $8 per ton, f.o.b. Jacksonville; 77 to 76 per cent pebble grades, $7.50; 75 to 74 per cent pebble, $6; 70 per cent pebble, $4.50; 66 to 68 per cent pebble, $4.10, f.o.b. Tampa.

Seventy-two per cent washed and unground, $6@$6.50 per long ton; 75 per cent kiln-dried lump, $6.50@$7; 65@70 per cent ground, $6@$6.50 per ton, f.o.b. Tennessee mines.

Pumice Stone—Imported lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Imported lump, 1 in. diameter and up, 11½c. per unit; furnace size, 2½ in. diameter, 12½c. per unit; fines, through ½-in. mesh, 11½c. per unit; cinder property of buyer, ex ship, Atlantic ports. Ore contains 50@51 per cent sulphur; cinder about 63 per cent metallic iron. Market weak.

Silica—Glass sand, generally $1.75@ $2.50 per ton, f.o.b. shipping point; sand-blast material, $2.50@$5. Ground 250 to 450 mesh, $20@$40, f.o.b. mills. Glass sand, $5@$10, f.o.b. Massachusetts.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—200 to 325 mesh, $14.75 per ton in carload lots, f.o.b. New York points; $8@$12 per ton depending upon fineness and color, f.o.b. Georgia points. Ground talc and soapstone in coarse grade, $7@$8 per short ton, f.o.b. Vermont shipping points.

Tripoli—Once ground, rose and cream colored, $16@$25; white, $18@$27; double ground, r. and c., $17@$25; w., $19@$30; air-float, r. and c., $25@$30; w., $35; super air-float, r. and c., $35@ $40; w., $40@$45. All per short ton in 200-lb. burlap bags with paper liners, minimum car, 30 tons, f.o.b. Missouri points. Market strong.

Mineral Products

Arsenious Oxide (white arsenic)— firm at 12@13c. per lb.

Copper Sulphate — Large crystals, 5.80c. per lb.; small, 5.70c.

Sodium Nitrate—$2.475 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate — Powder, domestic, $1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Sulphate—$25@$27 per ton, New York.

Ferro-Alloys

Ferrocerium—Per lb., $15@$20.

Ferrochrome—1 to 2 per cent carbon, 28c. per lb.; 4 to 6 per cent carbon. 12@14c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $101 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $36.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 15 per cent, $38 @$40 per gross ton, f.o.b. works; 50 per cent, $70@$75; 75 per cent, $115@$120.

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—95c. per lb. of contained W., f.o.b. works. Market firm.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$3.50@$4 per lb. of V contained, f.o.b. works. Market very active.

Metal Products

Copper Sheets—New York base, 21.50c. per lb.; wire, 15.625@15.875c. net.

Lead Sheets—Full lead sheets, 10.25c. per lb.; cut lead sheets, 10.50c. in quantity, mill lots.

Nickel Silver—29.25c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 19.50c. per lb.; rods, 16.50c. per lb.

Zinc Sheets—$9.25@$9.50 per 100 lb., f.o.b. works.

Refractories

Bauxite Brick—$45@$50 minimum, per net ton, f.o.b. shipping point.

Chrome Brick—$50@$52 per net ton, f.o.b. shipping point.

Chrome Cement — $23 per net ton, f.o.b. shipping point.

Firebrick—First quality, $43@$46 per M., Pennsylvania, Ohio, and Kentucky works; second quality, $39@$41.

Magnesite Brick — 9-in., straights. $70@$75 per net ton, f.o.b. works.

Magnesite Cement — $50.50@$52 per net ton, f.o.b. shipping points.

Silica Brick—$45@$47 per M., Pennsylvania; $50@$53, Indiana; $48@$50, Alabama.

[1]**Zirkite**—Powdered, $50@$60 per ton; brick, $100 per ton.

The Iron Trade

Pittsburgh, Nov. 28, 1922

The Steel Corporation has continued its former prices of $4.75 on tin plate and 3.35c. on sheets for deliveries after Jan. 1, disappointing a number of independents, who had expected advances. Bars, shapes, and plates continue quotable at 2c. but are not strong. Car shortages and embargoes are making it difficult for shipments to keep up with production.

Pig Iron.—There is practically no inquiry for bessemer or basic, and foundry iron business is confined to small lots for immediate requirements. The bessemer and basic markets are affected by offerings of steel works iron. Quotations are down $3.50 to $28.50 on bessemer, $1.50 to $26.50 on basic, and $1 to $27 on foundry, prices being at Valley furnaces, with $1.77 freight to Pittsburgh.

Connellsville Coke—Furnace coke is up 50c., at $7.25 to $7.50, and the better brands of foundry are off 50c., making the range $7.50@$8. Furnaces seem fairly well covered to the end of the year.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Germany Considering Imports of Zinc from America

Charlottenburg, Nov. 12.—Zinc is becoming increasingly scarce in Germany, and this country has been compelled to repurchase zinc already sold to Great Britain. Zinc people are looking ahead for imports of zinc from America, because the German parity for this metal is now above the American quotation.

A curious but at the same time characteristic feature of the present metal market is the negligible difference in price between standard copper (raffinadekupfer) and future zinc now ruling. Another feature is the gradual equalizing of prices between different lead brands, because every brand is being equally sought. The tin scarcity is being sharply felt; it is smoothed over only by the decrease in or entire absence of orders for locomotives from Russian and German railways. The tin production of Russia out of Bolivian ores may be put at around 6,500 metric tons for the current year, compared with 13,500 metric tons for 1913.

The amount of pyrites which may be imported this year from eastern Upper Silesia into Germany without duty has been established at 2,223,000 kilos; zinc residues, ashes, and other forms, at 440,000 kilos.

The metal-trading firm Samuel Baers Söhne at Halberstadt has retired from its shareholding of the Trotha refinery at Halle-on-Saale, the firms of Lissauer et Cie., Cologne, and Hugo Schneider Aktiengesellschaft, Leipzig, being left as proprietors.

The silver and platinum businesses have gone entirely under the control of large speculators. Platinum in particular, is being largely smuggled into France. It is generally believed here, rightly or wrongly, that the Paris platinum concern, Société du Platine, is the last receiver of the multitudinous small lots which are leaving Germany, because it is striving to regain its former monopolistic power in the international trade of platinum. Recently there has been some setback in the American platinum market without the German market having been greatly touched by it, because of incessant French buying.

Mining Trade Associations

The following list of mining trade associations has been compiled by the Natural Resources Production Department of the U. S. Chamber of Commerce with some modifications and additions made by *Engineering and Mining Journal-Press*. We ask the mining trade associations which are not represented to please advise us, thereby assisting the work of the U. S. Chamber of Commerce.

I.—General.
- American Mining Congress, Munsey Building, Washington, D. C.
- Association of Arizona Mining Men, Phoenix, Ariz.
- California Metal & Mineral Producers' Association, San Francisco, Calif.
- Chamber of Commerce and Mines, Douglas, Ariz.
- Chamber of Mines and Oil, Los Angeles, Calif.
- Idaho Mining Association, Mackay, Idaho.
- Montana Mining Men's Association, Helena, Mont.
- National Metal Trades Association, Chicago, Ill.
- Nevada Mine Operators' Association, Reno, Nev.
- Northwest Mining Association, Spokane, Wash.

II.—Clay.
- Association of American Clay Producers.

III.—Copper.
- Copper Producers' Association.
- Copper Export Association, New York, N. Y.
- Copper and Brass Research Association, New York, N. Y.

IV.—Emery and Corundum.
- Emery and Corundum Importers and Manufacturers' Association, Philadelphia, Pa.

V.—Gold.
- American Gold and Silver Institute, Washington, D. C.

VI.—Granite.
- International Monumental Granite Producers' Association, Boston, Mass.
- Granite Paving Block Association, New York, N. Y.

VII.—Graphite.
- Plumbago-Graphite Association, New York, N. Y.

VIII.—Gypsum.
- Gypsum Industries Association, Washington, D. C.

IX.—Iron and Steel.
- American Iron and Steel Institute, New York, N. Y.
- American Pig Iron Association, Pittsburgh, Pa.
- Association of American Steel Manufacturers, Pittsburgh, Pa.
- Lake Superior Iron Ore Association, Cleveland, Ohio.

X.—Kaolin.
- Southern Kaolin Miners' Association, Macon, Ga.

XI.—Lead.
- American Institute of Lead Manufacturers, New York, N. Y.

XII.—Limestone.
- National Agricultural Limestone Association, Columbus, Ohio.
- Indiana Limestone Quarrymen's Assocation, Bedford, Ind.

XIII.—Magnesia.
- Magnesia Association of America, Philadelphia, Pa.

XIV.—Magnesite.
- Western Magnesite Association, San Francisco, Calif.

XV.—Marble.
- National Association of Marble Dealers, Cleveland, Ohio.

XVI.—Petroleum.
- Petroleum Institute, New York, N. Y.
- Phosphate Export Association, New York, N. Y.
- Portland Cement Association, New York, N. Y.

XVII.—Slate.
- National Slate Association, 757 Drexel Building, Philadelphia, Pa.

XVIII.—Soapstone.
- Talc and Soapstone Producers' Association, Baltimore, Md.

XIX.—Stone.
- International Cut Stone Contractors and Quarrymen's Association, Chicago, Ill.

XX.—Tin.
- Tin Importers' Association, New York, N. Y.

XXI.—Zinc.
- American Zinc Institute, New York, N. Y.

Mining Dividends for November

The following dividends were paid by mining and metallurgical companies in November, 1922:

Companies in the United States	Situation	Per Share	Total
California Rand Silver	Calif.	$0.02	$25,600
Chief Consolidated, s.l.	Utah	0.10Q	88,403
Colorado Fuel & Iron pfd.	Colo.,N.M., Wyo.	2.00Q	40,000
Eagle & Blue Bell, s. l.	Utah	0.05	44,657
General Development Co.	U. S.	0.25Q	30,000
Homestake Mining, g.	S. D.	0.50M	125,580
International Nickel, pfd.	W.Va.,Ont.	1.50Q	133,689
Miami Copper	Ariz.	0.50Q	373,557
Mohawk Mining, c.	Mich.	1.00	100,000
New Cornelia Copper	Ariz.	0.25Q	450,000
New Jersey Zinc	U. S.	2.00Q	909,328
U. S. Steel pfd.	U. S.	1.75Q	6,304,919
United Verde Ext., c.	Ariz.	0.25Q	262,500
Companies in other countries:			
Amparo Mining, g.s.	Jalisco	0.03Q	60,000
Hollinger Consolidated, g.	Ont.	0.05 4 wks.	246,000
Lake Shore, g.	Ont.	0.02Q	40,000

Q, quarterly; M, monthly; s, silver; g, gold; l, lead;c, copper

Eagle & Blue Bell resumed paying dividends after suspending dividend payments in April 28, 1921. Homestake Mining doubled its previous disbursement, and is expected to continue on the 50c. monthly basis. The regular October dividend of Lucky Tiger Combination of 5c. per share, plus extra of 2c., plus special extra of 3c. for the third quarter, was paid on Oct. 5, but was not included in last month's table, owing to delay in receipt of the notice. A dividend of 7c. of the last-named company was presumably paid in November also.

Mexico's Mineral Production, Jan.-June, 1922

The Weekly News Bulletin of Mexico City, as reported in *Commerce Reports*, gives the output of minerals in Mexico for the first six months of 1922 as follows, the figures being in kilograms (2.2046 lb.):

Minerals	January-June	Minerals	January-June
Gold	11,145	Graphite	1,306,098
Silver	1,195,355	Arsenic	63,252
Lead	42,065,160	Mercury	17,045,380
Copper	6,479,008	Antimony	275,213
Zinc	1,064,929		

COMPANY REPORTS

Chief Consolidated Mining Co.

Silver, Lead; Utah

A report of the Chief Consolidated Mining Co. for the third quarter of 1922 shows a net profit of $100,585.07 after all charges. Of 26,008 tons produced, metal contents were 1,047 oz. gold, 739,833 oz. silver, and 3,927,686 lb. lead, with an average value of $37.78 per ton.

Balance sheet as of Sept. 30 follows:

ASSETS			
Property			
Mining claims—cost		$2,001,079.84	
Machinery and equipment		530,143.27	
Construction		37,094.84	
			$2,568,317.95
Mine investments (at or below cost)			
Plutus Mining Co's stock		$94,361.89	
Other investments		766,062.02	
			860,423.91
Current assets			
Bills receivable		$355,818.26	
Miscellaneous		41,216.17	
			397,034.43
Deferred charges			
Gemini mine operating expense			6,606.63
Liberty Bond investment			613,899.24
Cash			69,423.45
			$4,515,705.61
LIABILITIES			
Capital stock			
1,000,000 shares at $1		$1,000,000.00	
Less stock in treasury		115,295.00	
			$884,705.00
Surplus			
Dec. 31, 1921		$1,827,632.93	
Profits, 1922			
Gross receipts from sales of ore and lime rock	$2,318,275.33		
Less operating costs and for reserves for taxes and development of properties of subsidiary companies, but exclusive of depletion charges	1,836,129.53		
Net earnings	$482,145.80		
Interest on investments and deposits	15,570.29		
	$497,716.09		
Less dividend No. 31, 32 and 33	176,832.70	320,883.39	
			2,148,516.32
Bills payable			365,576.00
Current liabilities			167,799.56
Reserve accounts			
Reserve for taxes		$530,157.61	
Reserve for depreciation		243,951.12	
Reserve for development of properties of subsidiary companies		175,000.00	
			949,108.73
			$4,515,705.61

The important happening during the period covered by this report was the purchase by the company of the mines and all of the property of the Gemini Mining Co. and that of the Ridge Valley Mining Co. and also a controlling number of shares of the Eureka Mines Co., followed by purchase of a controlling number of shares of the Eureka Hill Mining Co.; the whole for a cost slightly exceeding $500,000, which amount $150,000 was paid down and the compan notes given for the balance, payable in four quarterly payments. Two of these mines have between them paid $4,000,000 to $5,000,000 in dividends. It is believed that they, together with the other two, under the more intensive and penetrating methods of the company's organization, may yet be made to yield much more profit. As with the Grand Central mine, considerable expenditures have to be made by the company in rehabilitating these properties to get them into service as producers, and the Gemini has already begun production of ore in a small way. The four properties embraced in this new purchase join the Chief mine and will ultimately become a part of its workings.

Temiskaming Mining Co., Ltd.

Silver; Ontario

A report of the operations of the Temiskaming Mining Co. for the year ended June 30, 1922, shows a net profit of $1,120.31, according to the following profit-and-loss statement:

Earnings		
Ore sales—residues at smelters	$1,006.96	
Interest earned	16,720.14	
Miscellaneous earnings	2.00	
		$17,729.10
Expenses		
Mine expenses	$5,691.14	
Head office expense	2,740.32	
General expense	1,806.27	
Municipal taxes	2,196.05	
Insurance	4,175.01	
		16,608.79
Net profit transferred to surplus		$1,120.31

Balance sheet as of June 30, 1922, follows:

ASSETS			
Current assets			
Cash in banks		$8,646.77	
Accounts receivable		16,581.56	
Inventories—mine stores		49,842.71	
			75,071.04
Investments			
Blue Diamind Coal Co., Ltd., and Canadian Coalfields, Ltd		$279,992.25	
Advances to Blue Diamond Coal Co., Ltd		290,000.00	
Cobalt hospital shares		1.00	
			569,993.25
Fixed assets			
Mining properties, Cobalt	$2,427,802.43		
Other mining claims	1.00		
		$2,427,803.43	
Plant and equipment	$308,265.42		
Less			
Reserve for depreciation	155,459.41	152,806.01	
			2,580,609.44
Deferred charges			
Unexpired insurance			1,437.50
			$3,227,111.23
LIABILITIES			
Current liabilities			
Accounts payable			$53.31
Capital liabilities			
Capital stock authorized		$2,500,000.00	
Issued and outstanding			2,500,000.00
Surplus			
Surplus June 30, 1921		$728,253.20	
Less			
Inventories and accounts receivable written off	$1,715.59		
Loss on Victory Bonds sold	600.00	2,315.59	
		$725,937.61	
Add net profit for year		1,120.31	
			727,057.92
			$3,227,111.23

Barnes-King Development Co.

Gold; Montana

A report of the Barnes-King Development Co. shows the following operating results for the quarter ended Sept. 30, 1922:

EARNINGS		
Interest		$1,137.72
Deduct:		
North Moccasin property expense less royalties received	$730.60	
Piegan-Gloster property expense, less royalties received	1,473.11	
Shannon property expense, less net bullion receipts	16,024.32	
Kendall property expense	163.64	
Strawn development expense, less ore shipment	3,125.71	
Miscellaneous expense	1,108.06	
		22,625.44
Difference being loss on operations for quarter ended Sept. 30, 1922		$21,487.72

The above figures include provisions for depreciation on the various plants of the company on the same basis as has been used heretofore.

MINING STOCKS

Week Ended Nov. 25, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	58	56	58	Aug. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2⅛	2	2		
Allouez	Boston	21⅛	20	20	Mar. '19	1.00
Anaconda	New York	48⅛	45⅛	45⅛	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅛	2	2⅛		
Ariz. Com'l.	Boston	7⅛	7	7	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*8	*7	*8		
Bingham Mines	Boston	18⅛	18	18⅛	Sept. '19, Q	0.25
Calumet & Arizona	Boston	54	52	53	Sept. '22, Q	0.50
Calumet & Hecla	Boston	275	260	270	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*2	*2	*2		
Centennial	Boston	†9	†8	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	39⅛	38	38	Mar. '21, Q	0.50
Chile Copper	New York	27⅛	25⅛	25⅞		
Chino	New York	24⅛	22⅛	22⅛	Sept. '20, Q	0.37
Copper Range	Boston	38	36⅛	37⅛	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅛	1⅛	1⅛		
Davis-Daly	Boston	3⅛	2⅛	2⅞	Mar. '20, Q	0.25
East Butte	Boston	8	7⅞	7⅞	Dec. '19, A	0.50
First National	Boston Curb	*50	*45	*45	Feb. '19, SA	0.15
Franklin	Boston	1⅛	1⅛	1⅛		
Gadsden Copper	Boston Curb	†*75	†*65	*70		
Granby Consol.	New York	24	22⅛	22⅛	May '19, Q	1.25
Greene-Cananea	New York	24	23⅛	24	Nov. '20, Q	0.50
Hancock	Boston	2	2	2		
Howe Sound	N. Y. Curb	2⅛	2⅛	2⅛	Jan. '21, Q	0.05
Inspiration Consol.	New York	34	31⅛	31⅛	Oct. '28, Q	1.00
Iron Cap	Boston Curb	5	4	4	Sept. '20, K	0.25
Isle Royale	Boston	20	19	19	Aug. '22,	0.50
Kennecott	New York	32⅛	30⅛	31⅛	Dec. '20, Q	0.50
Keweenaw	Boston	1⅛	1⅛	1⅛		
Lake Copper	Boston	3⅛	3⅛	3⅛		
Magma Copper	N. Y. Curb			34	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	2	2	2	Nov. '17, Q	1.00
Miami Copper	New York	25⅛	25⅛	25⅛	Nov. '22, Q	0.50
Michigan	Boston	2⅛	2	2		
Mohawk	Boston	57⅛	54	55	Nov. '22, Q	1.00
Mother Lode Coa.	N. Y. Curb			1	June '22, I	0.50
Nevada Consol.	New York	14⅛	13⅛	13⅛	Sept. '20, Q	0.25
New Cornelia	Boston	17	15⅛	15⅛	Nov. '22, Q	0.25
North Butte	Boston	9⅛	8⅛	9	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*37	*30	*30		
Old Dominion	Boston	18	16⅛	16⅛	Dec. '18, Q	1.00
Osceola	Boston	28	27	27	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†170	†160		Oct. '22, Q	1.00
Quincy	Boston	33	31	32	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅛	12⅛	12⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅛	1⅛	1⅛		
St. Mary's Min. Ld.	Boston	39⅛	37⅛	38⅛	Apr. '22, K	2.00
Seneca Copper	Boston	8	8	8		
Shannon	Boston	*67	*60	*67	Nov. '17, Q	0.25
Shattuck Arizona	New York	7⅛	7⅛	7⅛	Jan. '20, Q	0.25
South Lake	Boston	†1	†*30	*35		
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs.	New York	8⅛	8⅛	8⅛	May '18, I	1.00
Tuolumne	Boston	*42	*42	*42	May '13,	0.10
United Verde Ex.	Boston Curb	27	24	25⅛	Nov. '22, Q	0.25
Utah Consol.	Boston	2 1/16	1⅛	2	Sept '18,	0.25
Utah Copper	New York	62⅛	59⅛	60⅛	Sept. '22, Q	0.50
Utah Metal & T.	Boston	1⅛	1	1 1/16	Dec. '17,	0.30
Victoria	Boston	1	1	1		
Winona	Boston	1⅛	*95	*95		
Wolverine	Boston	8	7⅛	7⅛		
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	13⅛	13⅛	Mar. '19,	0.50
Internat. Nickel, pfd.	New York	75	75	75	Nov. '22, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	5	5	5		
National Lead	New York	118⅛	113	113⅛	Sept. '22, Q	1.50
National Lead, pfd.	New York	114⅛	113⅛	114⅛	Nov. '22, Q	1.75
St. Joseph Lead	New York	18⅛	18⅛	18⅛	Sept. '22, Q	0.25
ZINC						
Am. Z. L. & S.	New York	15⅛	14	14⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	50	49⅞	50	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅛	7	7	June '18,	0.50
Butte & Superior	New York	31	26	26⅛	Sept. '20,	1.25
Callahan Zn-Ld	New York	7⅛	7	7⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	165	164	165	Nov. '22, Q	2.00
Yellow Pine	Los Angeles			*75	Sept. '20, Q	0.03
SILVER						
Batopolias Mining	New York	⅛	⅛	⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*32	*30	*30½	May '20, K	0.03
Coniagas	Toronto	1.95	1.80	1.90	May '21, Q	0.12½
Crown Reserve	Toronto	*27⅜	*26½	*27	Jan. '17,	0.05
Kerr Lake	N. Y. Curb			3⅛	Oct. '22, Q	0.12½
La Rose	Toronto	*24	*22	*22	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*23	*19½	*20	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1	1	1	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Oct. '22, Q,X	0.30
Ontario Silver	New York	6	6	6	Jan. '19, Q	0.50
Temiskaming	Toronto	*34	*30	*32	Jan. '20, K	0.04
Trethewey	Toronto	5⅛	3	5	Jan. '19,	0.05

Stock	Exch.	High	Low	Last		Last Div
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1	1⅛		
Atlas	Toronto	*19	*18	*18⅛		
Carson Hill	Boston	6⅛	5⅞	6⅛		
Cresson Consol. G.	N. Y. Curb	2 1/16	2⅛	2⅛	Oct. '22 Q.	0.10
Dome Mines	New York	41⅛	40⅛	41⅛	Oct. '22, Q	0.50
Golden Cycle	Colo. Springs	†*92	†*88	*90	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	0.05
Hollinger Consol.	Toronto	11.80	11.55	11.65	Nov. '22,	0.05
Homestake Mining	New York	81	80	80	Nov. '22, M	0.50
Keora	Toronto	*9⅛	*8	*9		
Kirkland Lake	Toronto	*45	*43	*43⅛		
Lake Shore	Toronto	2.91	2.75	2.85	Nov. '22, Q	0.02
McIntyre- Porcupine	Toronto	17.70	16.90	17.00	Sept. '22, K	0.25
Porcupine Crown	Toronto	*22⅛	*21	*21	July '17,	0.03
Portland	Colo. Springs	†*40	†*38	*38	Oct. '20, Q	0.01
Schumacher	Toronto	*45	*41	*42		
Teck Hughes	Toronto	*89⅛	*88⅛	*88⅛		
Tom Reed	Los Angeles	*83	*80	*80	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅛	1 1/16	1 1/16	Oct. '22, Q	0.15
Vindicator Consol.	Colo. Springs	†*5		*4	Jan. '20, Q	0.01
Vipond Cons.	Toronto	*64	*61	*63		
White Caps Mining	N. Y. Curb	*11	*10	*10		
Wright-Hargreaves	Toronto	3.35	3.10	3.15	Oct. '22,	0.05
Yukon Gold	N. Y. Curb	*65	*60	*60	June '18,	0.02½
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*8	*6	*6		
Cons. Virginia	San Francisco	*13⅛	*11⅛	*11⅛		
Dolores Esperanza	N. Y. Curb	2⅛	2	2	Oct. '22	2.50
El Salvador	N. Y. Curb	*3	*2	*3		
MacNamara M.&M.	N. Y. Curb	*9	*8	*8	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1⅛	1⅛	1⅛	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*76	*72	*73		
Tonopah Extension	N. Y. Curb	3 1/16	3⅛	3⅛	Oct. '22, Q	0.05
Tonopah Mining	N. Y. Curb	2⅛	2 1/16	2⅛	Oct. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1 1/16	1 1/16	1 1/16	Sept. '22, Q.	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb			*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*40	*40	*40	Dec. '20,	0.15
Chief Consol.	Boston Curb	5⅛	5	5	Nov. '22, Q	0.10
Columbus Rexall	Salt Lake	*18	*18	*18	Aug. '22,	0.03
Consol. M. & S.	Montreal	27	27	27	Oct. '20, Q	0.62½
Eagle & Blue Bell	Boston Curb	†*3	†*2	*3	Nov. '22, K	0.05
Federal M. & S.	New York	10	10	10	Jan '09,	1.50
Federal M. & S. pfd.	New York	52⅛	50	50	Sept. '22, Q	1.25
Florence Silver	Spokane	*38	*37	*37	Apr. '19,	0.01½
Grand Central	Salt Lake		†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	9	8⅛	9	Sept. '22, Q	0.15
Iron Blossom Con.	N. Y. Curb			*28	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*10	*9	*9	June '21, I	0.02
Park City	Salt Lake	†5.80	†3.50	3.75		
Prince Consol.	Salt Lake	*9⅛	*6⅛	*6⅛	Nov. '17,	0.02½
Silversmith	Spokane	*45	*44	*44		
Stewart Mines	N. Y. Curb	*7	*6	*6	Dec. '15,	0.05
Tamarack-Custer	Spokane	2.60	2.50	2.60	Jan. '21, K	0.04
Tintic Standard	Salt Lake	3.15	3.07	3.10	Sept. '22, K	0.05
Utah Apex	Boston	3⅛	2⅛	3⅛	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	66⅛	60⅛	61⅛	Oct. '22	1.2
Char. Iron	Detroit			1 1/16		
Char. Iron, pfd.	Detroit			2⅛		
Colorado Fuel & Iron	New York	26⅛	24⅛	25⅛	May '21	0.75
Col. Fuel & Iron, pfd.	New York			105	Nov. '22	2.00
Gt. North'n Iron Ore	New York	31⅛	29⅛	30	Nov. '20	1.50
Inland Steel	N. Y. Curb			45⅛	Sept. '22	1.00
Mesabi Iron	N. Y. Curb	11⅛	11	11		
Replogle Steel	New York	24	21⅛	22⅛		
Republic I. & Steel	New York	50⅛	45⅞	45⅛	May '21	1.50
Rep. Iron & St., pfd	New York	85	82⅛	85	Jan. '22	1.75
Sloss-Sheffield S. & I.	New York	40	38	38	Feb. '21	1.50
U. S. Steel	New York	105⅛	101⅛	101⅛	Sept. '22	1.25
U. S. Steel, pfd.	New York	121⅛	121	121⅛	Nov. '22	1.75
Virginia I. C. & C.	New York	56	56	56	Jan. '22	1.50
Virginia I.C.&C.,pfd.	New York	81⅛	81⅛	81⅛	July '22	2.50
VANADIUM						
Vanadium Corp.	New York	35⅞	31⅛	31⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	67	66	67	Oct. '22, Q	1.50
Asbestos Corp. pfd.	Montreal	82⅛	82⅛	82⅛	Oct. '22, Q	1.75
SULPHUR						
Freeport Texas	New York	21⅛	19⅛	19⅛	Nov. '19, Q	1.00
Texas Gulf	New York	64⅛	59⅛	59⅛	Sept. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Metal	New York	47	44⅛	45⅛	Sept. '22,	0.75
Amer. Metal pfd.	New York	109⅛	108	108	Sept. '22, Q	1.75
Amer. Sm. & Ref.	New York	54⅛	50	50	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	100⅛	100⅛	100⅛	Sept. '22 Q	1.75
Am. Sm. Sec. pfd. A.	New York			101⅛	Oct. '22, Q	1.50
U. S. Sm. R. & M.	New York	36	36	36	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York			47⅛	Oct. '22 Q.	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

Throttle and Air Feed Control in Stoping Drills

An air-throttle control of the feed cylinder, which does away with outside brakes or mechanical retarding devices, is to be found in the rotating stoper drills manufactured by the Sullivan Machinery Co., Chicago, Ill.

The throttle control is of the standard lever type. With the hose valve turned to its wide-open position, the control of the drill and feed cylinder is placed under the one throttle. Turning the throttle first admits air to the air tube and oil pockets, and in the next position to the feed cylinder, raising the drill to its work. Further turning of the valve causes the hammer to recip-

Water stoper in use at Tintic Standard mine, Utah

rocate slowly, and in the final full-open position the machine is operated at full-speed and the feed cylinder receives full pressure.

Control of the rate of feed is obtained through a special throttle valve, which enables the upward advance of the feed cylinder on its piston rod to be governed at will. This valve is operated by a lever placed close to the throttle handle, so that the runner's hand grasps both at once. This new device is said to be simpler in construction and easier to operate than any other method now used for the purpose.

In spotting holes the throttle handle is operated in the regular manner, by grasping it and turning until air is slowly admitted to the feed cylinder, which slowly raises the tool until the bit just touches the face. The lever controlling the feed control valve is then squeezed with the fingers firmly until the valve seats and closes admission of the air to the feed cylinder. This traps the air in the feed cylinder and holds the tool in this position ready to spot the hole. The throttle handle is then turned toward the open position, and with the lever still held by the fingers firmly against the seat, the tool starts to operate. After spotting the hole, the lever is released by the fingers, allowing the air to again enter the feed cylinder and the amount of air entering or rate of advance of feed can be controlled by the lever, releasing it slightly from its seat if slow feed is wanted, as in going through soft or seamy ground, or releasing entirely, to secure the maximum feed pressure, as in even ground.

By merely squeezing the lever controlling the air to the feed cylinder, a very slow feed is obtained, or the feeding of the tool toward the face held stationary. If cuttings cause sticking of the steel in the hole by packing back of the bit, the hole can easily be cleaned by grasping the rotating handle, squeezing the lever, and churning the tool up and down on the trapped air in the feed cylinder as in cleaning the hole with an auger drill.

It is natural for an operator to keep his hand on the throttle valve handle, and in this manner it becomes a simple thing merely to squeeze the lever and control the feed or hold the stoper stationary. Another valuable point is that when the hole is finished or in changing steels, no time is lost waiting for the feed to telescope as is the case where brakes, clutches, or feed screws are employed. At the instant the throttle is closed the feed instantly telescopes and does not cause trouble by sticking or slowly telescoping to its closed position. This enables the operator to start immediately on a new hole.

A Multi-Stage Centrifugal Pump

Where pumps driven by motors of slow or moderate speeds must deliver water at pressures higher than are desirable or practicable for a single-stage pump, instead of using a single-suction multi-stage pump, two separate single-stage pumps are sometimes connected in series, so that one discharges into the suction of the other. In medium and smaller sizes, the use of two independent pumps in series becomes somewhat more cumbersome, and a multi-stage pump is more often used. The length of shaft permissible in a multi-stage pump is limited because of the critical speed, and if many stages are employed, the designer no longer has a free hand in providing water passages of the shape and size conducive to the highest efficiency. Consequently, where more than three stages are required, the single-suction impeller, which occupies less space on the shaft than does the double-suction impeller, and thus permits the use of a shorter shaft, is used.

However, it is not possible to obtain as high efficiencies with a commercial multi-stage single-suction pump as would be possible in a single-stage pump with double-suction impellers, not only because of the less favorable limitations imposed on the impeller, but also because there is not sufficient space for an efficient volute diffusor and suitable return passages leading from the diffusor to the eye of the succeeding impeller. The De Laval Steam Turbine Co., therefore developed a new type of multi-stage pump, known as a "series" pump, in which the advantages of the double-suction impeller are retained.

The double suction impeller gives perfect hydraulic balance, and two of the stuffing boxes which would be required if two separate casings were employed are eliminated, together with their friction.

INDUSTRIAL NOTES

The Power Specialty Co., which manufactures Foster superheaters, economizers, and oil-heating and cooling equipment, announces the opening of new branch offices in Detroit, Mich., in the Dime Savings Bank Building, in charge of L. Lanyi, and in Boulder, Colo., 2324 14th St., in charge of R. B. Nutting, who was formerly Chicago district manager.

Announcement has been made of the consolidation of Street Bros. Machine Works and the Patten Manufacturing Co., both manufacturers of hoisting machinery. The charter of Street Bros. Machine Works, Inc., will be expanded, and the products of the two companies will be manufactured and marketed by "Street Bros. Machine Works, Inc." J. H. Street is president of the enlarged company, and J. W. Burress is sales manager.

Frank Nickerson, for nine years connected with the San Francisco office of the Midvale-Cambria Steel Co., has severed his connections with that company to accept the position as southern California manager for the Bethlehem Steel Corporation. About the first of January he will open an office in the Washington Building, Third and Spring Sts., Los Angeles, Calif., for the Bethlehem Steel Corporation, covering all of southern California and Arizona.

The Roller-Smith Co., 233 Broadway, New York, manufacturers of electrical instruments, meters, and circuit breakers, announces the appointment of the Electric Material Co. as its agent in Washington and parts of Oregon and Idaho. The latter company has recently opened an office in the Hinckley Building, Seattle, which will be in charge of R. F. Robinson. The Electric Material Co.'s main office is at 589 Howard St., San Francisco, and the company also has a branch office in the Title Insurance Building, in Los Angeles.